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Index to

NUCLEAR SAFETY

A Technical Progress Review
by
Chronology, Permuted Title, and Author
Vol. 11 (1) through Vol. 19 (6)

Prepared for the U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Under Interagency Agreements DOE 40-551-75 and 40-552-75

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INDEX TO
NUCLEAR SAFETY
A TECHNICAL PROGRESS REVIEW
BY
CHRONOLOGY, PERMUTED TITLE, AND AUTHOR
VOL. 11(1) THROUGH VOL. 19(6)

Wm. B. Cottrell
Engineering Technology Division

Margaret Passiakos
Information Division

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FOREWORD

The Nuclear Safety Information Center (NSIC), which was established in March 1963 at Oak Ridge National Laboratory, is principally supported by the U.S. Nuclear Regulatory Commission's Office of Nuclear Regulatory Research. Support is also provided by the Division of Reactor Research and Technology of the Department of Energy. NSIC is a focal point for the collection, storage, evaluation, and dissemination of safety information to aid those concerned with the analysis, design, and operation of nuclear facilities. Although the most widely known product of NSIC is the technical progress review *Nuclear Safety*, the Center prepares reports and bibliographies as listed on the inside covers of this document. The Center has also developed a system of key words to index the information which it catalogs. The title, author, installation, abstract, and key words for each document reviewed are recorded at the central computing facility in Oak Ridge. The references are cataloged according to the following categories:

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19. Internal Exposure Effects on Humans Due to Radioactivity in the Environment (inactive September 1973)
20. Effects of Thermal Modifications on Ecological Systems (inactive September 1973)
21. Radiation Effects on Ecological Systems (inactive September 1973)
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J. R. Buchanan, Assistant Director
Nuclear Safety Information Center
P.O. Box Y
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

Telephone 615-574-0391
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ABSTRACT

This index to *Nuclear Safety* covers articles published in *Nuclear Safety*, Vol. 11, No. 1 (January—February 1970), through Vol. 19, No. 6 (November—December 1978). It is divided into three sections: a chronological list of articles (including abstracts) followed by a permuted-title (KWIC) index and an author index. *Nuclear Safety*, a bimonthly technical progress review prepared by the Nuclear Safety Information Center (NSIC), covers all safety aspects of nuclear power reactors and associated facilities. Over 500 technical articles published in *Nuclear Safety* in the last nine years are listed in this index.

INTRODUCTION

Nuclear Safety, a bimonthly technical progress review, is prepared by the Oak Ridge National Laboratory and is jointly sponsored by the Nuclear Regulatory Commission and the Department of Energy. The technical articles (i.e., excluding special reviews and features) are refereed and cover all topics relevant to the safe design, construction, and operation of nuclear facilities. In addition to that primary emphasis on power reactors, safety considerations in reactor fuel fabrication, spent-fuel processing, nuclear waste disposal, handling of radioactive materials, and the environmental effects of these operations are also treated.

Cumulative indexes of *Nuclear Safety* have been prepared annually since 1967. However, starting in 1974, the issues covered extended back only through Volume 11. This issue of the *Index to Nuclear Safety* covers articles included in *Nuclear Safety*, Vol. 11, No. 1, through Vol. 19, No. 6. Persons interested in an index to earlier *Nuclear Safety* volumes should purchase ORNL-NSIC-107 (see inside front cover).

This index is presented in three sections as follows:

Section 1 (orange) — Chronological List of Articles by Volume
Section 2 (white) — Permuted-Title (KWIC) Index
Section 3 (green) — Author Index

A KWIC (KeyWord In Context) index is one in which article titles are permuted around the various significant words contained therein. For example, the title, "Design Basis for Nuclear Power Plant Protection Systems," is indexed under the words Design, Nuclear, Power, Plant, and Protection. As may be seen by reference to Section 2 (white) of this report, the index words are arranged alphabetically in a column in the center of the page, with the titles permuted around them. In some cases, additional significant words in parentheses have been added to the title by the editors to allow more precise indexing. The location of the indexed articles in *Nuclear Safety* is indicated by the seven-digit numbers in the column to the right of the page, as described below. The KWIC code was developed by IBM and has proved to be a useful tool for the preparation of indexes for many different purposes.

Early issues of the index were used primarily for the benefit of the *Nuclear Safety* editors. However, it has been so helpful that it is now prepared and distributed as an NSIC report. The index is published annually following the close of each *Nuclear Safety* volume year.

The seven-digit index number given in all three sections is divided into four parts (00-0-0-000) which stand, respectively, for volume-number-section-page. It provides ready entry from the permuted-title (KWIC) index (white) and author index (green) to the main index (orange), which gives title, author, and abstract when available. Corporate affiliation is given in the orange section for all authors. Abstracts are also included for those articles that contained one. Volume 11 corresponds to 1970; Volume 12, 1971; Volume 13, 1972; Volume 14, 1973; Volume 15, 1974; Volume 16, 1975; Volume 17, 1976; Volume 18, 1977; and Volume 19, 1978.

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Section 1

CHRONOLOGICAL MAIN INDEX

Nuclear Safety articles are indexed in this section by volume in the chronological order of their appearance in the Journal. Titles (white section) and authors (green section) are keyed to this main index by means of a seven-digit number in the left-hand column; the number is divided into four parts (00-0-0-000), which stand for volume-number-section-page, respectively. Following the index number are the appropriate article title and author. For example, Vol. 11, No. 1, Sect. 3, p. 20 (11-1-3-020) contained the article, "The Design Basis for Nuclear Power Plant Protection Systems," by R. S. Stone (see index). The dates pertinent to each volume are listed in the introduction. Abstracts are included in this section for all articles that had one.

BIBLIOGRAPHY

11-1-1-001 THE LIQUID METAL FAST BREEDER REACTOR SAFETY PROGRAM
BAKER, L., JR. + ROSE, D. + MILLER, C. E., JR.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS
THE GENERAL AIM OF THE LIQUID METAL FAST BREEDER REACTOR SAFETY PROGRAM IS THE IMPROVEMENT OF THE TECHNOLOGICAL BASE NEEDED TO UNDERSTAND ACCIDENT SITUATIONS, TO DEVELOP SAFETY SYSTEMS, AND TO DEVELOP STANDARDS AND CODES FOR SAFE DESIGN, SITING, CONSTRUCTION, AND OPERATION OF AEC TEST FACILITIES AND COMMERCIAL LIQUID METAL FAST BREEDERS. IN ITS SCOPE THE PROGRAM INCLUDES STUDIES OF THE PHENOMENA ASSOCIATED WITH ABNORMAL OPERATION, POTENTIAL ACCIDENTS, AND SAFETY SYSTEMS DESIGNED TO PREVENT ACCIDENTS OR TO LIMIT THEIR CONSEQUENCES. EMPHASIS IS PLACED ON PREVENTION, EARLY DETECTION, AND CONTROL OF POTENTIAL ACCIDENTS.

11-1-2-012 ANALYSIS OF PRESSURE PULSES PRODUCED IN A WATER CHANNEL BY RAPID HEATING
UCHIDA, H. + YAMURA, T.
UNIVERSITY OF TOKYO, TOKYO, JAPAN
A BASIC INVESTIGATION WAS MADE OF THE POWERFUL PULSELIKE PRESSURE INCREASES THAT OCCUR IN A NARROW WATER CHANNEL WHEN THE WATER IS BEING HEATED RAPIDLY. IN THE EXPERIMENTS A VERTICAL WATER COLUMN WAS HEATED AT THE BOTTOM, AND THE TOP OF THE WATER WAS A FREE SURFACE. TEMPERATURE CHANGE RATES ON THE HEATER SURFACE WERE VARIED FROM 3000 TO 25,000C/SEC. THE INVESTIGATION INDICATED THAT THE PRESSURE CHANGES IN A CHANNEL UNDERGOING RAPID HEATING EXHIBIT TWO KINDS OF PATTERNS, NAMELY, AN INITIAL INCREASE TO A PEAK PRESSURE THAT IS INFLUENCED BY THE HEATING RATE AND THEN A SERIES OF PRESSURE PULSES THAT CAN BE EXPLAINED ANALYTICALLY AS A DYNAMICS PROBLEM SIMILAR TO THAT ASSOCIATED WITH A WATER HAMMER. IN THIS SECOND STAGE THE MAXIMUM PRESSURE IS GREATER THAN THE PEAK PRESSURE IN THE FIRST STAGE. THESE PRESSURE CHANGES ARE SIMILAR TO PRESSURE CHANGES OBSERVED IN BORAX AND SPERT EXPERIMENTS.

11-1-3-020 THE DESIGN BASIS FOR NUCLEAR POWER PLANT PROTECTION SYSTEMS
STONE, H. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE DESIGN BASIS FOR A NUCLEAR PLANT PROTECTION SYSTEM GIVES FUNCTIONAL REQUIREMENTS AND ESTABLISHES THE CIRCUMSTANCES UNDER WHICH THE SYSTEM MUST BE CAPABLE OF OPERATING. IT TAKES INTO ACCOUNT BOTH THE SYSTEM'S CHARACTERISTICS AND THOSE OF THE ENTIRE COMPLEX OF PROTECTIVE FEATURES. THESE LATTER CHARACTERISTICS CONSIST IN THOSE ASPECTS OF PLANT DESIGN THAT FORESTALL, ABORT, OR MITIGATE HAZARDOUS OCCURRENCES IN THE POWER-GENERATING CHAIN. THE BASIC REQUIREMENTS ARE TO ENSURE PUBLIC SAFETY AND, IF POSSIBLE, TO PREVENT DAMAGE TO THE PLANT. A PROPER DESIGN BASIS TIES TOGETHER ALL THE INFORMATION NECESSARY FOR THE DEVELOPMENT OF A COMPETENT PLANT PROTECTION SYSTEM. WITHOUT SUCH A DESIGN BASIS, THE SYSTEM WILL BE HAPHAZARD AND INCOMPLETE.

11-1-4-025 A REVIEW OF THE TECHNOLOGY OF PRESTRESSED CONCRETE REACTOR PRESSURE VESSELS
TAN, C. P.
FRANKLIN INSTITUTE RESEARCH LABORATORIES, PHILADELPHIA, PENNSYLVANIA
PRESTRESSED CONCRETE REACTOR VESSELS (PCRV'S) ARE ADAPTABLE TO LARGE NUCLEAR CORES AND THE HIGH PRESSURES NEEDED FOR THE SAFE AND ECONOMICAL PRODUCTION OF NUCLEAR POWER WITH GAS-COOLED REACTORS. THERE ARE AT PRESENT 18 PCRV'S, MOST OF WHICH ARE IN GREAT BRITAIN AND FRANCE. IN THE UNITED STATES A PCRV FOR THE FORT ST. VRAIN HIGH TEMPERATURE GAS-COOLED REACTOR IS UNDER CONSTRUCTION. THE BASIC PROBLEMS FACING THE DESIGNER AND CONSTRUCTOR OF PCRV'S WERE (1) LACK OF APPLICABLE CODES, (2) LITTLE KNOWLEDGE OF LONG TERM BEHAVIOR OF CONCRETE UNDER MULTIAXIAL STRESSES AT HIGH TEMPERATURE, (3) LITTLE INFORMATION ON STRESS CONCENTRATIONS IN CONCRETE DUE TO PENETRATIONS OF VARIOUS SIZES AND TO THE ANCHORAGES, (4) POROSITY OF CONCRETE, AND (5) LIMITED CAPACITY OF COMMERCIALLY AVAILABLE PRESTRESSING SYSTEMS. MOST OF THESE PROBLEMS HAVE BEEN RESOLVED THROUGH ENGINEERING INGENUITY COMPLEMENTED WITH EXTENSIVE RESEARCH AND DEVELOPMENT. SATISFACTORY DESIGNS OF PCRV'S HAVE BEEN ACCOMPLISHED BY DEVELOPING SOPHISTICATED ANALYTICAL METHODS AND TESTING STRUCTURAL MODELS. PCRV'S APPEAR TO BE FAVORED FOR ADVANCED REACTORS BECAUSE OF ADAPTABILITY WITH RESPECT TO SIZE AND PRESSURE.

11-1-5-034 VARIABILITY OF WIND DIRECTION WITHIN THE UNITED STATES
SINGER, I. A. + NAGLE, C. M.
BROOKHAVEN NATIONAL LABORATORY, UPTON, L.I., NEW YORK
INCREASED INTEREST IN ATMOSPHERIC DIFFUSION PROBLEMS (PARTICULARLY, FOR NUCLEAR SAFETY HEADERS, AS RELATED TO THE SITING OF NUCLEAR POWER REACTORS) HAS CREATED NEED FOR A QUANTITATIVE MEASURE OF THE VARIABILITY OF THE MEAN WIND DIRECTION WITH TIME. IT HAS BEEN PROPOSED THAT THE CONSTANCY OF THE WIND, DEFINED AS THE MEAN VECTOR WIND DIVIDED BY THE MEAN SCALAR WIND (V/V), BE USED FOR SIMPLE CLASSIFICATION PURPOSES. A TRIGONOMETRIC TRANSFORMATION IS USED TO LINEARIZE THE

VARIATION OF CONSTANCY WITH THE MEAN ANGULAR RANGE OF DIRECTION. THIS FUNCTION, CALLED THE STEADINESS, S, IS THEN COMPUTED FOR VARIOUS TIME PERIODS, AND BY USE OF EXTREME-VALUE THEORY THE RECURRENCE INTERVALS OF VARIOUS MEAN WIND DIRECTION RANGES CAN BE PREDICTED. THIS HAS BEEN DONE FOR 34 STATIONS IN THE UNITED STATES. RECURRENCE INTERVAL MAPS OF THE STEADINESS OF WIND DIRECTION WITHIN THE UNITED STATES FOR VARIOUS TIME PERIODS ARE PRESENTED THAT SHOW THE INTERRELATION OF GEOGRAPHICAL LOCATION AND SYNOPTIC METEOROLOGY WITH WIND DIRECTION PERSISTENCE. THE MOST PERSISTENT WIND DIRECTIONS APPEAR AT COASTAL STATIONS, AND THE LEAST PERSISTENT OCCUR IN MOUNTAINOUS REGIONS.

11-1-5-039 U.S.A. STANDARD N13.2-1969 - GUIDE FOR ADMINISTRATIVE PRACTICES IN RADIATION MONITORING (A GUIDE FOR MANAGEMENT)
HART, J. C. + MOELLER, D. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE - HARVARD SCHOOL OF PUBLIC HEALTH, BOSTON, MASSACHUSETTS
RADIATION PROTECTION IN ANY NUCLEAR-BASED OPERATION IS A RESPONSIBILITY OF MANAGEMENT. THE USA STANDARD N13.2 IS DESIGNED TO PROVIDE A GENERAL REVIEW OF THE TYPE AND EXTENT OF MONITORING NEEDED FOR THE SAFE USE AND APPLICATION OF RADIATION SOURCES. THIS STANDARD MAY BE USED DURING THE PLANNING STAGES OF AN OPERATION AS A GUIDE TO AN EFFECTIVE MONITORING PROGRAM.

11-1-5-043 TURNOVER AND CONCENTRATION OF RADIONUCLIDES IN FOOD CHAINS
REICHLE, D. E. + DUNAWAY, P. B. + NELSON, D. J.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
PROLIFERATION OF NUCLEAR TECHNOLOGY AND CONCERN FOR RADIOACTIVITY IN THE BIOSPHERE DEMAND MORE SOPHISTICATED EVALUATIONS OF FUTURE NUCLEAR INSTALLATIONS AND PROCEDURES. ADEQUATE ANALYSES OF RADIONUCLIDE DISPERSION IN THE ENVIRONMENT WILL REQUIRE MORE SUBSTANTIAL BIOENVIRONMENTAL INFORMATION THAN IS PRESENTLY AVAILABLE. FREQUENTLY INFORMATION KNOWN FOR ONE ECOLOGICAL SYSTEM (E.G., ARCTIC TUNDRA) WILL NOT BE APPLICABLE TO OTHER ECOSYSTEMS (E.G., TEMPERATURE OR TROPICAL FORESTS). ONLY WITH SUFFICIENT ECOLOGICAL DATA CAN PREDICTIVE MODELS BE DEVELOPED THAT WILL ENABLE ASSESSMENT OF THE ENVIRONMENTAL CONSEQUENCES OF RADIOACTIVE CONTAMINATION. A SIMPLE SOURCE PATHWAY RECEPTOR MODEL, ANALOGOUS TO THE ECOLOGICAL FOOD CHAIN, REQUIRES PATHWAY IDENTIFICATION, DATA ON ASSIMILATION BY EACH LINK (ORGANISM) IN THE PATHWAY, AND DETERMINATION OF THE BIOLOGICAL TURNOVER OF EACH RADIONUCLIDE. FOR ACUTE RELEASES OF RADIOACTIVITY TO THE ENVIRONMENT, EVALUATION OF THESE VARIABLES IS NEEDED TO PREDICT TIME DEPENDENT CONCENTRATIONS OF RADIOACTIVITY IN ORGANISMS. FOR CHRONIC RELEASES, CONCENTRATION FACTORS ALONE WILL OFTEN SUFFICE. THE BIOLOGICAL CONCENTRATION AND TURNOVER OF RADIONUCLIDES BY ANIMALS ARE SUMMARIZED IN THIS PAPER. DATA ARE PRESENTED FOR USE IN ENVIRONMENTAL MODELS AND CORRELATION WITH SPECIES CHARACTERISTICS (E.G., BODY SIZE) THAT ALLOW ESTIMATION OF ABSOLUTE VALUES FOR MANY DIFFERENT ANIMAL GROUPS BASED ON EXISTING EXPERIMENTAL DATA.

11-2-1-107 INDUSTRIAL SABOTAGE IN NUCLEAR POWER PLANTS
TURNER, S. E. + MCCULLOUGH, C. R. + LYERLY, R. L.
SOUTHERN NUCLEAR ENGINEERING, INC., DUNEDIN, FLORIDA
THE CONSEQUENCES OF INDUSTRIAL SABOTAGE IN NUCLEAR POWER PLANTS HAVE BEEN STUDIES FROM THE STANDPOINT OF THE POTENTIAL HAZARD TO THE HEALTH AND SAFETY OF THE PUBLIC. THIS EVALUATION OF THE POTENTIAL THREAT OF SABOTAGE CONSIDERED (1) HISTORICAL PRECEDENTS, (2) THE OPINIONS OF EXPERIENCED AND KNOWLEDGEABLE INDIVIDUALS, (3) MOTIVATION AND LIKELY EXTENT OF KNOWLEDGE OF VARIOUS TYPES OF SABOTEURS, AND (4) AN ASSESSMENT OF THE PROBABILITY AND POSSIBLE CONSEQUENCES OF A NUMBER OF POSTULATED SABOTAGE ACTS, AS WELL AS THE LEVEL OF DAMAGE NECESSARY TO CREATE A PUBLIC HAZARD. ON THE BASIS OF THE STUDY, IT IS CONCLUDED THAT, ALTHOUGH SABOTAGE WITH SERIOUS CONSEQUENCES TO THE PUBLIC IS POSSIBLE IN THEORY, THE PROBABILITY IS SUFFICIENTLY LOW THAT NO UNDUE RISK TO THE HEALTH AND SAFETY OF THE PUBLIC EXISTS.

11-2-3-115 AUTOMATION OF REACTOR CONTROL AND SAFETY SYSTEMS AT ORNL
OAKES, L. C.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
REACTOR SAFETY FUNCTIONS REQUIRING FAST RESPONSE ARE AUTOMATED, BUT OBJECTIONS ARISE WHEN SOME TRADITIONALLY MANUAL OPERATIONS ARE PROPOSED FOR AUTOMATION. IN A REACTOR CONTROL SYSTEM, PERHAPS MORE THAN IN ANY OTHER, THE OPERATOR IS DEPENDENT ON SENSORY INSTRUMENTATION FOR DETERMINING THE OPERATING STATE. COMPARISONS OF RELIABILITY, OPERABILITY, ECONOMICS, AND SAFETY FOR AUTOMATIC VS. MANUAL CONTROL ARE ABOUT THE SAME IF SIMILAR PERFORMANCE IS EXPECTED. THESE ARE EXEMPLIFIED BY DISCUSSIONS OF AUTOMATIC STARTUPS AND SHIMMING. OPERATOR JUSTIFICATION IS EVEN NOW SOMEWHAT PHILOSOPHICAL, AND RESULTS OF CURRENT RESEARCH AND DEVELOPMENT IN COMPUTER CONTROL AND DIAGNOSTIC TECHNIQUES WILL FURTHER TEND TO REDUCE HIS ROLE. A GREATER AMOUNT OF AUTOMATION THAN NOW USED WOULD LEAD TO IMPROVED SAFETY AND OPERABILITY.

11-2-4-119 CONSTRUCTION OF A SITE ASSEMBLED NUCLEAR REACTOR PRESSURE VESSEL
REEDY, K. F. + SIMS, J. E.
CHICAGO BRIDGE AND IRON COMPANY, OAK BROOK, ILLINOIS - CHICAGO BRIDGE AND IRON COMPANY, MEMPHIS, TENNESSEE
THE MONTICELLO NUCLEAR GENERATING PLANT IN MINNESOTA, OWNED BY NORTHERN STATES POWER COMPANY, IS UNIQUE IN THAT IT HAS THE FIRST FIELD FABRICATED NUCLEAR REACTOR PRESSURE VESSEL BUILT IN THE UNITED STATES. THE MATERIALS FOR THIS VESSEL WERE FABRICATED IN THE NORMAL MANNER AND SHIPPED TO THE SITE FOR FINAL ASSEMBLY INTO A COMPLETED VESSEL. SPECIAL TRAINING FOR FIELD MACHINING, WELDING, AND QUALITY CONTROL WAS REQUIRED. THE COMPLETION OF THE PRESSURE VESSEL AHEAD OF SCHEDULE SHOWED THAT THE FIELD FABRICATION OF NUCLEAR PRESSURE VESSELS IS BOTH FEASIBLE AND ECONOMICAL.

11-2-5-130 STATUS OF INVESTIGATIONS OF SALT FORMATIONS FOR DISPOSAL OF HIGHLY RADIOACTIVE POWER REACTOR WASTES
MCCLAIN, W. C. + BRADSHAW, R. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
A COMMITTEE OF THE NATIONAL ACADEMY OF SCIENCES FIRST SUGGESTED THE USE OF SALT FORMATIONS FOR THE DISPOSAL OF RADIOACTIVE WASTES IN 1955, AND FEASIBILITY STUDIES BEGAN AT OAK RIDGE NATIONAL LABORATORY AND ELSEWHERE AS EARLY AS 1957. BY THE EARLY 1960'S, EMPHASIS HAD SHIFTED FROM DIRECT DISPOSAL OF LIQUID WASTES TO SOLIDIFICATION AND DISPOSAL OF THE RESULTING SOLIDS. A CONCEPT FOR DISPOSAL OF SUCH SOLIDS IN A SALT MINE WAS DEVELOPED, AND PREPARATIONS FOR A DEMONSTRATION EXPERIMENT BEGAN IN 1963. THE RADIOACTIVE PHASE OF THIS DEMONSTRATION BEGAN IN NOVEMBER 1965 AND SUCCESSFULLY DEMONSTRATED THE FEASIBILITY AND SAFETY OF HANDLING HIGHLY RADIOACTIVE MATERIALS IN AN UNDERGROUND ENVIRONMENT. THIS EXPERIMENT ALSO DEMONSTRATED THE STABILITY OF SALT UNDER THE EFFECTS OF HEAT AND RADIATION. DATA OBTAINED ON THE CREEP AND PLASTIC FLOW CHARACTERISTICS OF SALT HAVE MADE IT POSSIBLE TO ARRIVE AT A SUITABLE MINE DESIGN FOR A DISPOSAL FACILITY. A STUDY OF THE ECONOMICS OF DISPOSAL IN SALT MINES INDICATES THAT THIS METHOD WILL BE COMPATIBLE WITH COMPETITIVE NUCLEAR POWER. AN ANALYSIS OF THE PROJECTED POWER REACTOR WASTES AND THE SAFETY CONSIDERATIONS INVOLVED POINTS TO THE NEED FOR A GOVERNMENT OWNED WASTE REPOSITORY TO BE IN OPERATION BEFORE 1980.

11-2-6-142 SAN ONOFRE EXPERIENCE WITH APPARENT POWER MISMATCH AND REACTOR COOLANT TEMPERATURE ANOMALIES
ORTEGA, O. J. + JOHNSON, C. G. + BASKIN, K. P.
SOUTHERN CALIFORNIA EDISON COMPANY, LOS ANGELES, CALIFORNIA
IN JANUARY 1968 THE UPPER LIMIT FOR OPERATION AT THE SAN ONUFRE NUCLEAR GENERATING STATION WAS SET AT 90 PERCENT POWER, 405 MW(E), BECAUSE DISCREPANCIES HAD BEEN NOTED IN REACTOR THERMAL POWER AS RECKONED BY DIFFERENT METHODS. CALCULATIONS BASED ON THE TEMPERATURE DIFFERENTIALS ACROSS THE STEAM GENERATOR IN THE PRIMARY LOOPS GAVE ONE VALUE, AND CALORIMETRICS IN THE SECONDARY SYSTEM GAVE ANOTHER. IT APPEARED THAT COOLANT FLOW WAS LESS THAN THE DESIGN VALUE. EXTENSIVE TESTING DURING MARCH, SEPTEMBER, AND OCTOBER 1968 REVEALED THAT TEMPERATURE SENSORS GAVE MISLEADING INDICATIONS BECAUSE OF THEIR LOCATIONS. ACCORDINGLY, ADDITIONAL DIRECT IMMERSION RESISTANCE TEMPERATURE DETECTORS (RTD'S) WERE INSTALLED DOWNSTREAM OF EACH COOLANT PUMP TO GIVE ACCURATE COLD-LEG MIXED-MEAN TEMPERATURES. ACCURATE CORE OUTLET TEMPERATURES WERE ALREADY BEING PROVIDED BY CORE THERMOCOUPLES. THE DATA FROM THE NEW RTD'S PROVED THAT COOLANT FLOW ACTUALLY WAS EQUAL TO OR GREATER THAN DESIGN FLOW. ON THE STRENGTH OF THIS KNOWLEDGE, OPERATION AT 100 PERCENT POWER RATING, 450 MW(E), WAS BEGUN IN DECEMBER 1968 AFTER AN 18-MONTH INVESTIGATION OF THE ANOMALY. THE PROBLEM DEMONSTRATED THE GREAT NEED FOR INSTRUMENTATION TO ACCURATELY READ TWO PERFORMANCE PARAMETERS IN LARGE PWR'S (1) MIXED-MEAN HOT- AND COLD-LEG TEMPERATURES AND (2) FLOW OF PRIMARY COOLANT.

11-3-1-185 THE UTILITY'S ROLE IN NUCLEAR SAFETY RESEARCH AND DEVELOPMENT
MOORE, J. B.
SOUTHERN CALIFORNIA EDISON COMPANY, LOS ANGELES, CALIFORNIA
PLANNING FOR NEW ELECTRICITY GENERATING UNITS IN LARGE UTILITIES IS CHARACTERIZED BY CONTRACTING FOR A SERIES OF SIMILAR UNITS TO BE OPERATIONAL OVER A SPAN OF YEARS BEFORE CHANGING TO A DIFFERENT DESIGN. DELAYS, CAUSED BY DESIGN CHANGES MADE NECESSARY BECAUSE OF EQUIPMENT PROBLEMS AND BY CHANGING REQUIREMENTS IN REACTOR LICENSING, UPSET THIS ORDERLY GROWTH AND HAVE A CASCADING EFFECT SO THAT A SERIOUS RISK OF ELECTRICAL BLACKOUTS ENSUES DURING THE TRANSITION FROM FOSSIL FUELED TO NUCLEAR FUELED ELECTRICITY GENERATION. THE UTILITY'S ROLE IS TO ASSURE FEEDBACK OF OPERATING EXPERIENCE AND PROPER EVALUATION OF THE FEED-FORWARD TO STANDARDS AND CRITERIA THAT OCCURS PRIOR TO ACTUAL OPERATING EXPERIENCE.

11-3-2-195 STUDIES OF FAST REACTOR CORE BEHAVIOR UNDER ACCIDENT CONDITIONS
DICKERMAN, C. E.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS
STUDIES OF FAST REACTOR CORE BEHAVIOR UNDER ACCIDENT CONDITIONS ARE INCLUDED IN THE COMPREHENSIVE USAEC SAFETY PROGRAM. INFORMATION IS NOW BECOMING AVAILABLE ON VAPORIZATION, PRESSURE GENERATION, AND VOIDING OF SODIUM COOLANT UNDER TRANSIENT HEATING. SEMIEMPIRICAL MODELS OF OXIDE FUEL FAILURE ARE BEING DEVELOPED FROM TRANSIENT EXPERIMENT DATA. THE COMPLEX RELATIONS

BETWEEN FUEL FAILURE, MELTDOWN, AND SECONDARY MOVEMENTS OF FUEL AND COOLANT ARE BEING STUDIED IN SODIUM FILLED CAPSULES, AUTOCLAVES, AND LOOPS. DATA NOW AVAILABLE INDICATE THAT, IN SOME CASES AT LEAST, THE REAL BEHAVIOR MAY BE SIGNIFICANTLY LESS HAZARDOUS THAN PREDICTIONS BASED ON LIMITING CASE MODELS REQUIRED IN THE ABSENCE OF ACTUAL DATA.

11-3-3-206 PROTECTION INSTRUMENTATION SYSTEMS IN LIGHT WATER-COOLED POWER REACTOR PLANTS
O'BRIEN, M. G. + WALKER, C. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
CURRENT PRACTICES IN PROTECTION SYSTEM DESIGNS VARY WIDELY, INDICATING DIFFERENCES IN DESIGN CRITERIA, AS WELL AS THE LACK OF COMMONLY RECOGNIZED 'BEST WAYS' IN DESIGN APPROACHES FOR CARRYING OUT SIMILAR FUNCTIONS. THE DESIGN OF THE INSTRUMENTATION SYSTEMS FOR THE ENGINEERED SAFETY FEATURES PRESENTS A CONSIDERABLY MORE COMPLEX PROBLEM THAN THE DESIGN OF THE REACTOR SHUTDOWN SYSTEM. EXAMINATIONS OF THE DESIGNS OF FOUR TYPICAL PROTECTION INSTRUMENTATION SYSTEMS FOR BOILING AND PRESSURIZED WATER POWER REACTORS INDICATED THAT (1) DESIGNS SHOULD BE EFFECTIVELY DOCUMENTED, (2) LOGICAL AND APPROPRIATE REQUIREMENTS FOR PERFORMANCE AND RELIABILITY SHOULD BE ESTABLISHED, AND (3) DETAILED CRITERIA ARE NEEDED FOR INSTRUMENTATION SYSTEM DESIGN.

11-3-4-215 THE ICE CONDENSER REACTOR CONTAINMENT SYSTEM
WEEMS, S. J. + LYMAN, W. G. + HAGA, P. R.
MPR ASSOCIATES, INC., WASHINGTON, D.C. - WESTINGHOUSE PWR SYSTEMS DIVISION, PITTSBURGH, PENNSYLVANIA
THE ICE CONDENSER REACTOR CONTAINMENT SYSTEM, WHICH WAS DESIGNED AND DEVELOPED AT WESTINGHOUSE ELECTRIC CORPORATION, EMPLOYS BORATED ICE AS A STATIC HEAT SINK FOR RAPID ABSORPTION OF ENERGY THAT MIGHT BE RELEASED THROUGH RUPTURE OF REACTOR COOLANT PIPING. THE CONCEPT IS ADAPTABLE TO ALL CURRENT TYPES OF COMMERCIAL NUCLEAR POWER PLANTS. THE BASIC DESIGN PHILOSOPHY, SYSTEM PARAMETERS, AND FULL SCALE SECTION PROOFTESTING CONDUCTED TO ESTABLISH THE SOUNDNESS AND PRACTICALITY OF THE CONCEPT ARE DESCRIBED, AS WELL AS THE FIRST PLANT APPLICATIONS - THE DONALD C. COOK NUCLEAR PLANT FOR THE AMERICAN ELECTRIC POWER SYSTEM AND THE SEQUOYAH NUCLEAR PLANT FOR THE TENNESSEE VALLEY AUTHORITY.

11-3-4-223 RESEARCH ON THE USE OF CONTAINMENT BUILDING SPRAY SYSTEMS IN PRESSURIZED WATER REACTORS
ROM, T. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
MANY OF THE PRESSURIZED WATER REACTORS OPERATING OR UNDER CONSTRUCTION INCLUDE CONTAINMENT BUILDING PRESSURE REDUCTION SPRAY SYSTEMS DESIGNED TO INCORPORATE A FISSION PRODUCT SEQUESTERING ADDITIVE. A PROGRAM TO EVALUATE ALL ASPECTS OF THE USE OF A SPRAY SYSTEM AS AN ENGINEERED SAFETY FEATURE HAS BEEN COORDINATED BY OAK RIDGE NATIONAL LABORATORY FOR THE AEC SINCE MARCH 1967. THE MAJOR RESEARCH EFFORT HAS BEEN CENTERED AT OAK RIDGE NATIONAL LABORATORY, WITH ADDITIONAL WORK BEING DONE AT BATTELLE-NORTHWEST AND THROUGH PRIVATELY SPONSORED RESEARCH BY THE NUCLEAR INDUSTRY. CURRENT EVALUATIONS INDICATE THAT SPRAY SYSTEMS WILL RAPIDLY REMOVE MOLECULAR IODINE AND THAT METHYL IODIDE AND PARTICULATE REMOVAL ARE SIGNIFICANTLY SLOWER PROCESSES. RADIOLYTIC HYDROGEN GENERATION BY POSTACCIDENT COOLING OF THE REACTOR CORE INTRODUCES A SIGNIFICANT DESIGN CONSIDERATION.

11-3-6-235 RADON CONCENTRATION IN REACTOR CONTAINMENT BUILDINGS MASQUERADES AS IODINE-131 RELEASE
CLACK, H. W. + ECKHOFF, R. D.
KANSAS STATE UNIVERSITY, MANHATTAN, KANSAS
THE CONTAINMENT BUILDING AIR AT THE KANSAS STATE UNIVERSITY TRIGA MARK II REACTOR BECAME CONTAMINATED WITH RADON, WHICH PRESUMABLY CAME FROM THE THAWING GROUND JUST OUTSIDE THE VENTILATION INTAKE. GAMMA-RAY SPECTRUM ANALYSIS IDENTIFIED THE CONTAMINATION AS RADON AND ITS PROGENY INSTEAD OF IODINE-131, WITH WHICH IT CAN BE CONFUSED. A SIMILAR INCIDENT OCCURED IN 1962 AT THE UNION CARBIDE REACTOR IN STERLING FOREST, NEW YORK.

11-3-6-237 A COMPARISON OF TWO NITROGEN-16 RADIATION SUPPRESSION DEVICES FOR TWO TYPES OF RESEARCH REACTOR FUEL
CASHWELL, R. J.
UNIVERSITY OF WISCONSIN, MADISON, WISCONSIN
PERSONNEL AT THE UNIVERSITY OF WISCONSIN NUCLEAR REACTOR HAVE MADE DETAILED RADIATION MEASUREMENTS FOR COMPARING THE EFFICIENCY OF A PLEXIGLAS PLATE TYPE NITROGEN-16 DIFFUSER WITH AN 80 GAL/MIN JET-TYPE DIFFUSER. ALTHOUGH MUCH LESS EFFECTIVE THAN THE JET-TYPE DIFFUSER, THE PLATE TYPE DIFFUSER OFFERS GREATER SIMPLICITY AND RELIABILITY AND WITH NO REACTIVITY DISTURBANCES.

11-4-1-283 SAFETY ASSESSMENT OF FAST SODIUM-COOLED REACTORS IN THE UNITED KINGDOM
FARMER, F. R.
UKAEA HEALTH AND SAFETY BRANCH, RISLEY, WARRINGTON, ENGLAND
THE BUILDING OF ANY REACTOR INTRODUCES SOME RISK TO THE PUBLIC, BUT IT APPEARS THAT THE FAST REACTOR MAY PRESENT LESS RISK THAN CURRENT REACTORS BECAUSE IT CAN BE DESIGNED SO AS NOT TO REQUIRE A POWER SOURCE WHEN SHUT DOWN, SINCE IT IS UNLIKELY THAT IT CAN EVER BE POSITIVELY ESTABLISHED THAT EVERY ENERGY RELEASE CAN ALWAYS BE CONTAINED, RELIANCE MUST BE PLACED IN THE

GREATER LIKELIHOOD OF IDENTIFYING THE FAULT AND SHUTTING DOWN THE REACTOR. THE OBJECTIVE OF CURRENT SAFETY RESEARCH IS TO PROVIDE TWO INDEPENDENT MECHANICAL SHUTDOWN SYSTEMS ACTIVATED BY INDEPENDENT SIGNALS. MEANS ARE BEING DEVELOPED FOR DETECTION OF FUEL SUBASSEMBLY FAILURES THROUGH DELAYED NEUTRONS, FISSION PRODUCTS, ACOUSTICS, AND POSSIBLY THE SHOCK OF SUBASSEMBLY COLLAPSE.

11-4-2-289 RECENT DEVELOPMENTS IN FAST REACTOR KINETICS
BUTLER, D. K. + MENELEY, D. A.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS
ANALYSIS OF THE SAFETY OF A FAST BREEDER REACTOR REQUIRES CALCULATION OF THE TIME DEPENDENT NEUTRON FLUX AND FISSION POWER DENSITIES. METHODS FOR THESE CALCULATIONS WHICH ARE REVIEWED ARE THOSE BASED ON NEUTRON DIFFUSION THEORY - POINT KINETIC, ADIABATIC, QUASI-STATIC, AND EXACT SOLUTIONS. THE METHODS ARE USED IN DIGITAL COMPUTER PROGRAMS IN COMBINATION WITH THOSE CALCULATIONS OF MECHANICAL CHANGES, FLUID FLOW, AND HEAT TRANSFER WHICH ARE REQUIRED FOR THE ANALYSIS OF STABILITY AND ACCIDENTS. LIMITATIONS OF COMPUTER CAPABILITY REQUIRE THE USE OF APPROXIMATE METHODS WHERE APPLICABLE. COMPARISON OF RESULTS OBTAINED WITH EACH METHOD SHOWS THAT THE QUASI-STATIC OR EXACT SOLUTION IS REQUIRED TO OBTAIN ACCURATE VALUES FOR POWER GENERATION DURING SEVERE TRANSIENTS. INCORPORATING THESE MORE ACCURATE METHODS INTO COMPUTER PROGRAMS WHICH INCLUDE EQUALLY ACCURATE CALCULATIONS OF THE THERMAL AND MECHANICAL EFFECTS WILL BE IMPORTANT IN DEVELOPING COMPUTER CODES FOR ACCIDENT ANALYSIS.

11-4-2-296 TORNADO CONSIDERATIONS FOR NUCLEAR POWER PLANT STRUCTURES
DOAN, P. L.
UNITED ENGINEERS AND CONSTRUCTORS, INC., PHILADELPHIA, PENNSYLVANIA
DESCRIPTIONS OF THE CHARACTERISTICS OF TORNADOES ARE PRESENTED THAT ARE BASED ON DOCUMENTED INFORMATION. THE NUCLEAR PLANT LIFETIME TORNADO RISK IS ASSESSED, AND MECHANISTIC CALCULATIONAL TECHNIQUES ARE PRESENTED TO DETERMINE THE EFFECTS ON PLANT STRUCTURES OF DYNAMIC WIND FORCES, STATIC PRESSURE DIFFERENTIALS, AND TORNADO GENERATED MISSILES. PARTICULAR ATTENTION IS GIVEN TO THE EFFECTS OF THE DESIGN TORNADO ON THE SPENT FUEL STORAGE POOL. POTENTIAL LOSS OF WATER BY ENTRAINMENT, SUCTION, EVAPORATION, AND RADIAL PRESSURE DIFFERENTIALS IS ASSESSED. ON THE BASIS OF HIGHLY CONSERVATIVE ASSUMPTIONS, IT IS SHOWN THAT THE SPENT FUEL STORAGE POOLS OF EXISTING LIGHT WATER REACTORS ARE QUITE ADEQUATELY DESIGNED TO ENSURE SAFE CONTAINMENT OF FISSION PRODUCTS IN THE EVENT THE DESIGN TORNADO OCCURS.

11-4-3-309 THE THIRD RELIABILITY MEETING AT RISO
LEONARDINI, L.
EUROPEAN NUCLEAR ENERGY AGENCY, PARIS, FRANCE
AN INTERNATIONAL MEETING ON RELIABILITY PROBLEMS RELATED TO THE SAFETY OF THE MECHANICAL COMPONENTS AND SYSTEMS IN NUCLEAR REACTORS WAS HELD IN DENMARK DURING SEPTEMBER 1969. TWENTY-EIGHT PAPERS WERE PRESENTED BY REPRESENTATIVES FROM NINE COUNTRIES. RELIABILITY ENGINEERING TECHNIQUES WERE DESCRIBED, AND THE NEED FOR FAILURE DATA COLLECTION SYSTEMS AND BANKS WAS DISCUSSED. MUCH REMAINS TO BE DONE WITH RESPECT TO APPLICATION OF THE DATA.

11-4-4-315 INTERNATIONAL CONGRESS ON THE DIFFUSION OF FISSION PRODUCTS
ROW, T. H. + DAVIS, R. J.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
AN INTERNATIONAL CONGRESS ON THE DIFFUSION OF FISSION PRODUCTS SPONSORED BY THE FRENCH SOCIETY FOR RADIOPROTECTION WAS HELD AT SACLAY, FRANCE, NOV.4-6.1969. THE MEETING WAS ATTENDED BY 218 DELEGATES REPRESENTING 16 COUNTRIES AND 3 INTERNATIONAL AGENCIES. PRESENTED WERE 30 PAPERS AND 4 SUMMARY REPORTS. THE SCOPE OF THE CONGRESS WAS SUFFICIENTLY BROAD THAT ESSENTIALLY ALL PHASES OF FISSION PRODUCT RELEASE AND TRANSPORT WERE INCLUDED. APPROXIMATELY TWO-THIRDS OF THE PAPERS PRESENTED AT THE CONGRESS WERE DEVOTED TO FISSION PRODUCT RELEASE BEHAVIOR AND REMOVAL UNDER WATER-COOLED AND GAS-COOLED REACTOR CONDITIONS. THE REMAINING PAPERS WERE ADDRESSED TO LMFBR (LIQUID METAL COOLED FAST BREEDER REACTOR) CONDITIONS.

11-4-6-323 THE ORR EMERGENCY COOLING FAILURE
EPLER, E. P.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THREE IDENTICAL UNITS THAT SUPPLY EMERGENCY POWER FOR AFTERHEAT PROTECTION OF THE OAK RIDGE RESEARCH REACTOR FAILED SIMULTANEOUSLY, AND THE REACTOR WAS OPERATED WITHOUT EMERGENCY POWER FOR THE AFTERHEAT REMOVAL SYSTEM FOR 5 HR BEFORE THE CONDITION WAS DISCOVERED. THE INCIDENT WAS CAUSED BY SEVEN COMMON MODE FAILURES OR ERRORS IN THREE IDENTICAL CHANNELS - A TOTAL OF 21 FAILURES. HAD ANY ONE OF THESE NOT HAPPENED, THE REACTOR WOULD NOT HAVE BEEN STARTED UP WITHOUT THE AVAILABILITY OF EMERGENCY COOLING FROM THE THREE INOPERATIVE UNITS. THE REACTOR WAS NOT ENDANGERED BECAUSE A DISSIMILAR UNIT OF LOW RELIABILITY WAS ACTIVATED. IT IS NOTEWORTHY THAT THIS PROBLEM OCCURRED IN A PLANT WITH AN OUTSTANDING SAFETY AND AVAILABILITY RECORD.

11-5-1-365 AEC GOES PUBLIC - A CASE HISTORY
BROWN, H. C., JR.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.
IN THE SPRING OF 1969, THE U.S. ATOMIC ENERGY COMMISSION DECIDED TO TAKE THE CASE FOR NUCLEAR POWER DIRECTLY TO THE PUBLIC BY WAY OF THE TOWN HALL AND THE VILLAGE SQUARE, THE UNIVERSITY SYMPOSIUM, AND THE SPEAKER CIRCUIT. A FACTUAL APPROACH HAS BEEN USEFUL IN COUNTERING MISINFORMATION AND IN ALLAYING UNFOUNDED FEARS, BUT THE INITIAL OUTINGS ALSO DEMONSTRATED THAT THE FACTS DO NOT ALWAYS SPEAK FOR THEMSELVES BECAUSE THEY ARE HIGHLY COMPLEX AND OCCASIONALLY CHALLENGED BY SMALL SEGMENTS OF THE SCIENTIFIC FRATERNITY. IT HAS BEEN NECESSARY TO TRANSLATE TECHNICAL JARGON INTO EVERYDAY LANGUAGE AND TO LEARN TO COMPETE WITH THE SHOWMANSHIP OF CRITICS. THE NEED FOR NUCLEAR ELECTRIC POWER IS INCREASINGLY RECOGNIZED, BUT NO SUBSTANTIAL ABATEMENT IN PUBLIC CONCERN FOR THE ENVIRONMENT IS IN SIGHT. LARGER SEGMENTS OF THE PUBLIC RECOGNIZE THAT THE SOLUTION TO THE ENVIRONMENTAL PROBLEM IS NEITHER TO TURN THE CLOCK BACK NOR THE LIGHT SWITCH OFF, AND THEY ARE PREPARED TO PAY A LITTLE MORE FOR A CLEAN ENVIRONMENT.

11-5-1-369 THE WATER REACTOR SAFETY PROGRAM PLAN
BRADBURN, P. F. + COOPER, C. H. + GILMORE, C. E.
IDAHO NUCLEAR CORPORATION, IDAHO FALLS, IDAHO
A USAEC REPORT DESIGNATED WASH-1146 HAS BEEN ISSUED TO SET FORTH A COMPREHENSIVE PLAN FOR USE BY THE DIVISION OF REACTOR DEVELOPMENT AND TECHNOLOGY IN ITS ADMINISTRATION OF WATER-REACTOR SAFETY PROGRAM AND FOR INFORMING THE NUCLEAR INDUSTRY CONCERNING THE SCOPE AND OBJECTIVES OF THE SPECIFIC PROJECTS THAT COMPRISE THE PROGRAM. THE REPORT COMPILES AND CORRELATES THE PROBLEMS AND INFORMATION NEEDS OF REACTOR SAFETY AND ASSIGNS PRIORITIES TO THE VARIOUS FACETS OF THE OVERALL PROBLEM. THE VIEWS EXPRESSED, ALTHOUGH NOT HELD UNIVERSALLY THROUGHOUT THE INDUSTRY, DO GENERALLY REPRESENT A CONSENSUS DETERMINED FROM COMMENTS SOLICITED FROM ALL MAJOR USERS OF SAFETY-RELATED INFORMATION, AND THE DOCUMENT THEREFORE FORMS AN AGREED-UPON BASIS UPON WHICH FUTURE CONSIDERATION AND DISCUSSION OF THE WATER-REACTOR SAFETY PROGRAM CAN BE FOUNDED. IT IS EXPECTED THAT THE PLAN WILL BE USED TO ASSURE THAT THE RESOURCES AVAILABLE TO THE SAFETY PROGRAM ARE APPLIED WHERE MOST NEEDED.

11-5-2-375 CRITERIA AND REQUIREMENTS FOR NDT PLANT PROTECTION SYSTEMS
WALKER, C. S.
TENNESSEE VALLEY AUTHORITY, KNOXVILLE, TENNESSEE
A SET OF GENERAL DESIGN CRITERIA AND REQUIREMENTS FOR REACTOR PROTECTION SYSTEMS HAS BEEN ISSUED AS A TENTATIVE STANDARD FOR APPLICATION TO REACTORS AND CRITICAL ASSEMBLIES UNDER THE JURISDICTION OF THE USAEC DIVISION OF REACTOR DEVELOPMENT AND TECHNOLOGY. THIS STANDARD, C 16-1T, INCLUDES WITHIN ITS SCOPE ALL THE ACTIVE DEVICES, SUCH AS INSTRUMENTS, ACTUATORS, AND ELECTRIC POWER SUPPLIES, NECESSARY TO PREVENT UNACCEPTABLE RELEASE OF RADIOACTIVE MATERIALS OR UNACCEPTABLE PLANT DAMAGE. THIS STANDARD APPLIES TO THE OVERALL BEHAVIOR OF THE PROTECTION SYSTEM, RATHER THAN TO THE DESIGN OF INDIVIDUAL EQUIPMENT ITEMS. THE MAJOR SECTIONS ARE DESIGN BASIS, CRITERIA AND REQUIREMENTS, AND QUALITY ASSURANCE. EMPHASIS IS GIVEN THE DESIGN BASIS SECTION, WHICH PRESCRIBES THE INTERDISCIPLINARY INFORMATION AND ANALYSES FOR SPECIFYING THE NECESSARY PROTECTIVE FUNCTIONS, TOGETHER WITH THE SYSTEM-RELIABILITY REQUIREMENTS. CRITERIA ARE THEN GIVEN FOR PROVIDING DEFENSES AGAINST VARIOUS KINDS OF FAILURES AND FOR ACCOMODATING THE SYSTEMS AND PROCEDURES REQUIRED TO OPERATE THE PLANT NORMALLY.

11-5-3-379 LMFBR SAFETY I. FISSION PRODUCT BEHAVIOR IN SODIUM
CASTLEMAN, A. W., JR.
BROOKHAVEN NATIONAL LABORATORY, UPTON, L.I., NEW YORK
THE POTENTIAL HAZARD PRESENTED BY THE POSSIBILITY OF FISSION-PRODUCT AND PLUTONIUM TRANSPORT FROM LIQUID METAL COOLED REACTORS INTO THE ENVIRONMENT IS A MAJOR FACTOR IN REACTOR SITING, DESIGN, AND OPERATION. FORTUNATELY CONSIDERABLE INFORMATION ON THE BEHAVIOR OF FISSION PRODUCTS IN SODIUM SYSTEMS IS AVAILABLE WITH WHICH TO ASSESS THEIR FATE UNDER CONDITIONS LIKELY TO EXIST BOTH DURING REACTOR OPERATION AND IN THE EVENT OF AN ACCIDENT. XENON AND KRYPTON ARE THE ONLY FISSION PRODUCTS THAT EXERT LARGE PARTIAL PRESSURES AND ARE THE ONLY ONES LIKELY TO BE SIGNIFICANTLY RELEASED IN THE ABSENCE OF EXTENSIVE SODIUM VAPORIZATION. UNDER INERT CONDITIONS FISSION-PRODUCT IODINE REACTS WITH SODIUM AND, EXCEPT POSSIBLY AT HIGH CONCENTRATIONS WITHIN THE SODIUM THERMAL BOND OF A FUEL ELEMENT, WILL PROBABLY BE RETAINED IN THE LIQUID SODIUM. THE ALKALINE METALS WILL DISTRIBUTE BETWEEN THE COOLANT AND THE SURFACES EXPOSED TO SODIUM. ALTHOUGH LARGE FRACTIONS WILL VAPORIZE IN THE EVENT OF SIGNIFICANT SODIUM VAPORIZATION, ANALYSIS OF THE BEHAVIOR OF BARIUM AND STRONTIUM REQUIRES FURTHER STUDY. HOWEVER, IT IS KNOWN THAT THEIR VOLATILITY IS LOW, AND THEY WILL PROBABLY INTERACT WITH THE OXYGEN DISSOLVED IN REACTOR-GRADE SODIUM AND DEPOSIT ON THE PRIMARY-SYSTEM PIPING. CALCULATIONAL METHODS ARE AVAILABLE FOR PREDICTING THE MAXIMUM EXTENT OF VAPORIZATION OF CS, RB, SR, I (AS NAI), BA, TE, AND SB AS A FUNCTION OF SODIUM VAPORIZATION.

11-5-4-351 RADIOACTIVE WASTE DISPOSAL BY HYDRAULIC FRACTURING
DE LAGUNA, W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE PETROLEUM INDUSTRY HAS DEVELOPED, LARGELY SINCE WORLD WAR II, THE TECHNIQUE OF HYDRAULIC FRACTURING TO INCREASE OIL RECOVERY THAT IS TODAY ALMOST UNIVERSALLY USED IN RESERVOIR ROCKS OF LOW PERMEABILITY. SINGLE INJECTIONS OF 100,000 GAL OF OIL CONTAINING 250,000 LB OF SAND ARE NOT UNUSUAL. MUCH THE SAME EQUIPMENT AND PROCEDURE MAY BE USED FOR WASTE DISPOSAL, ALTHOUGH THERE ARE CERTAIN SIGNIFICANT DIFFERENCES. THE DISPOSAL WELL AT OAK RIDGE WAS DRILLED AND CASED TO A DEPTH OF 1000 FT IN SHALE BY USING STANDARD OIL-FIELD METHODS. THE CASING IS SLOTTED NEAR THE BOTTOM, AND FOR WASTE DISPOSAL A SELF-HARDENING MIXTURE OF WASTE, PORTLAND CEMENT, AND CLAY IS PUMPED DOWN UNDER HIGH PRESSURE TO FORM A WIDESPREAD, THIN, HORIZONTAL FRACTURE IN THE SHALE IN WHICH THE WASTE SETS UP SOLID. AFTER FOUR INJECTIONS INTO THE SAME SLOT, TOTALING ROUGHLY 500,000 GAL, THE BOTTOM OF THE WELL IS PLUGGED AND A NEW SLOT CUT SOME 10 FT HIGHER UP THE WELL. PROBLEMS THAT HAD TO BE SOLVED AT OAK RIDGE TO MAKE POSSIBLE THE OPERATIONAL DISPOSAL OF MEDIUM-LEVEL RADIOACTIVE WASTE WERE (1) DETERMINING THE GEOMETRY OF THE FRACTURES FORMED IN THE SHALE, (2) ESTABLISHING THE FORMULA FOR A SATISFACTORY WASTE-CEMENT-CLAY MIX, (3) DESIGNING AND CONSTRUCTING THE SURFACE PLANT, AND (4) FORMULATING METHODS OF MONITORING THE OPERATION.

11-6-1-435 BEAM SAFETY CONSIDERATIONS AT THE STANFORD LINEAR ACCELERATOR CENTER
JENKINS, T. M.
STANFORD LINEAR ACCELERATOR CENTER, PALO ALTO, CALIFORNIA
THE HEALTH PHYSICS DEPARTMENT AT THE STANFORD LINEAR ACCELERATOR CENTER (SLAC) ACTIVELY PARTICIPATES WITH THE RESEARCH AREA DEPARTMENT IN PROBLEMS RELATED TO SAFE BEAM TRANSPORT AND SHIELDING. THE RESULT OF SUCH PLANNING AND DESIGN IS SET FORTH IN AN OPERATIONAL DOCUMENT KNOWN AS THE BEAM AUTHORIZATION SHEET, WHICH, ALONG WITH THE RADIATION RULE BOOK, PROVIDES THE GUIDELINES THROUGH WHICH THE ACCELERATOR, BEAM SWITCHYARD, AND RESEARCH AREA ARE OPERATED SAFELY. PLANNING AND OPERATIONAL PHASES OF RADIATION PROTECTION AT SLAC INCLUDE (1) PRIMARY ELECTRON- AND POSITRON-BEAM CONTAINMENT, (2) CONTROL OF DANGEROUS SECONDARY-BEAM AREAS AND ANY THAT ARE POTENTIALLY DANGEROUS, (3) RADIATION AND SHIELDING CALCULATIONS, (4) BEAM CHECK-OUT PROCEDURES AND MEASUREMENTS, AND (5) ROUTINE MONITORING. SEVERAL CLASSIC EXAMPLES ILLUSTRATE THE INGENUITY REQUIRED TO SATISFY THE SAFETY CRITERIA ESTABLISHED AT SLAC, AND THE INFORMATION PRESENTED SHOULD BE OF PARTICULAR INTEREST TO THOSE WHO ARE PLANNING NEW ACCELERATORS.

11-6-1-445 A SYSTEMS APPROACH TO NUCLEAR PLANT SAFETY
SNEDEKER, J. T.
GENERAL ELECTRIC COMPANY, SAN JOSE, CALIFORNIA
THE COMPLEXITY AND ADVANCED TECHNOLOGY OF TODAY'S NUCLEAR PLANTS WARRANT A NEW LOOK AT NUCLEAR PLANT SAFETY. THE EVALUATION TECHNIQUE ADVANCED IS BASED ON DEFINING THE EVENTS FOR WHICH A NUCLEAR PLANT MUST BE DESIGNED AND THEN SPECIFYING THE UNACCEPTABLE CONSEQUENCES OF THOSE EVENTS. IT IS THEN POSSIBLE TO SYSTEMATICALLY ANALYZE THE PLANT TO IDENTIFY THE ACTIONS, SYSTEMS, AND COMPONENTS ESSENTIAL TO ACCOMMODATING THE SPECIFIED EVENTS SO THAT UNACCEPTABLE RESULTS ARE NOT OBTAINED. THE ACTIONS, SYSTEMS, AND COMPONENTS IDENTIFIED AS ESSENTIAL MUST THEN BE DESIGNED AND OPERATED IN SUCH A WAY THAT SPECIFIED STANDARDS OF REDUNDANCY AND QUALITY ARE MAINTAINED. IN THIS WAY PLANT DESIGN AND OPERATION REFLECT A COMPREHENSIVE AND CONSISTENT BALANCE WITH RESPECT TO NUCLEAR SAFETY.

11-6-2-450 EQUATION OF STATE FOR FAST REACTOR SAFETY STUDIES 1. THEORETICAL RELATIONS
MILLER, D.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS
THE EQUATION OF STATE IS IMPORTANT IN FAST REACTOR SAFETY STUDIES BECAUSE IT COUPLES THE RATE OF ENERGY DEPOSITION WITH THE DEFORMATIONS AND DAMAGE THAT CAN BE PRODUCED IN AN ACCIDENT. THIS FIRST PART OF A TWO-PART REVIEW DISCUSSES THE APPLICATION OF THE EQUATION OF STATE TO REACTOR PROBLEMS AND INDICATES IMPORTANT PROPERTIES AND PROCESSES, ALONG WITH LIMITATIONS ON THEIR APPLICABILITY. THE EQUATION OF STATE IS A COMPLEX ENTITY, WITH BOTH THERMAL AND MECHANICAL DEPENDENCIES. BECAUSE OF THE WIDE RANGE OF CONDITIONS THAT MIGHT BE IMPORTANT IN ACCIDENT ANALYSES, CONSIDERATION MUST BE GIVEN TO A WIDE VARIATION OF PROPERTIES. MATERIALS OF PRINCIPAL INTEREST ARE THE FUEL AND FERTILE MATERIALS (METALLIC OR CERAMIC), CLADDING AND STRUCTURAL MATERIALS (GENERALLY IRON ALLOYS), AND THE SODIUM COOLANT, EACH HAS SPECIAL CHARACTERISTICS. ALTHOUGH EXPERIMENTAL DATA ARE AVAILABLE FOR MANY OF THESE MATERIALS, THEORY AND EMPIRICISM MUST BE USED TO EXTEND AND APPLY THE DATA. PART 2 OF THIS REVIEW, SCHEDULED FOR AN EARLY ISSUE OF NUCLEAR SAFETY, WILL EMPHASIZE SOME METHODS OF MEASUREMENT AT EXTREME CONDITIONS, INCLUDING THE POSSIBLE USE OF REACTORS, AND THE STATUS OF KNOWLEDGE ABOUT SPECIFIC REACTOR MATERIALS.

11-6-2-463 FIFTH GERMAN SYMPOSIUM ON PROGRESS IN SAFETY EVALUATION OF NUCLEAR POWER PLANTS
NEPHEW, E. A.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE FIFTH GERMAN SYMPOSIUM ON PROGRESS IN THE DEVELOPMENT OF NEW METHODS FOR SAFETY ANALYSIS OF NUCLEAR POWER PLANTS WAS SPONSORED BY THE INSTITUTE FOR REACTOR SAFETY AND WAS HELD IN HAMBURG, GERMANY, OCT. 27-28, 1969. TEN PAPERS WERE PRESENTED IN THREE DIFFERENT SESSIONS, AND AMPLE TIME WAS PROVIDED FOR DETAILED DISCUSSION OF THE TOPICS. COVERED AND EXTENSIVELY DISCUSSED WERE THE RELIABILITY ANALYSES OF COMPONENTS AND SYSTEMS, AS WELL AS THE ACQUISITION AND USE OF FAILURE DATA, IN THE DESIGN OF REACTOR PLANTS. IT WAS GENERALLY CONCLUDED THAT EXISTING FAILURE DATA ARE INADEQUATE FOR ABSOLUTE RISK ASSESSMENTS BUT CAN BE VERY USEFUL FOR IMPROVING PLANT AVAILABILITY AND COMPARING THE CONSEQUENCES OF ACCIDENTS. ACCORDINGLY, COLLECTION OF FAILURE DATA SHOULD BE ENCOURAGED, BUT THE USE OF THESE DATA IN RELIABILITY ANALYSES CANNOT NOW REPLACE THE MAXIMUM CREDIBLE ACCIDENT CONCEPT AS A BASIS FOR SAFETY ASSESSMENT.

11-6-3-468 INSTRUMENTATION FOR MONITORING THE HYPOTHETICAL LOSS-OF-COOLANT ACCIDENT IN LARGE LIGHT WATER POWER REACTORS
ROBINSON, T. G. + DUGGINS, B. C.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
VARIOUS ENGINEERED SAFETY FEATURES AVAILABLE IN NUCLEAR FUELED COMMERCIAL POWER STATIONS WOULD BE CALLED UPON TO COPE WITH THE CONSEQUENCES OF A LOSS-OF-COOLANT ACCIDENT. THESE SAFETY FEATURES ARE PROVIDED WITH INSTRUMENTS TO INITIATE OPERATION AND TO MONITOR CONTINUED OPERATION, WHEN THE SAFETY FEATURES WERE CALLED UPON. THE PLANT OPERATOR WOULD NEED INFORMATION REGARDING BOTH THE OPERATION OF THESE EMERGENCY SYSTEMS AND EQUIPMENT AND THE CONTINUING SUCCESS OF THEIR MISSION. A BRIEF STUDY WAS CONDUCTED TO DETERMINE THE TYPES AND EXTENT OF INSTRUMENTATION AVAILABLE IN THE DESIGNS OF REPRESENTATIVE NUCLEAR POWER PLANTS OF THE LATEST GENERATION FOR MONITORING THE COURSE OF A LOSS-OF-COOLANT ACCIDENT. THE FOUR PLANTS SURVEYED APPEARED TO HAVE ADEQUATE AND SUFFICIENT INSTRUMENTATION FOR MONITORING THE OPERATION OF THE EQUIPMENT IN THE ENGINEERED SAFETY SYSTEM FOR THE CASE OF A SUCCESSFULLY CONTAINED LOSS-OF-COOLANT ACCIDENT. HOWEVER, INSTRUMENTS FOR DIRECTLY DETECTING UNEXPECTED DAMAGE TO THE REACTOR CORE APPEAR TO BE LACKING.

11-6-4-475 SYMPOSIUM ON MEDICAL RADIONUCLIDES - RADIATION DOSE AND EFFECTS
CLOUTIER, R. J.
OAK RIDGE ASSOCIATED UNIVERSITIES, OAK RIDGE, TENNESSEE
THE DIVISION OF BIOLOGY AND MEDICINE OF THE U.S. ATOMIC ENERGY COMMISSION AND THE ENVIRONMENTAL CONTROL ADMINISTRATION OF THE U.S. PUBLIC HEALTH SERVICE WERE THE SPONSORS OF THE SYMPOSIUM ON MEDICAL RADIONUCLIDES - RADIATION DOSE AND EFFECTS, HELD IN OAK RIDGE, TENN., DEC. 8-11, 1969. THIS SYMPOSIUM WAS ONE OF A SERIES ON MEDICAL USES OF RADIONUCLIDES CONDUCTED BY THE MEDICAL DIVISION OF THE OAK RIDGE ASSOCIATED UNIVERSITIES. THE TOPICS OF THE 32 INVITED PAPERS MAY BE GROUPED INTO THREE GENERAL CATEGORIES - (1) MATHEMATICS FOR CALCULATING RADIATION DOSE TO A PATIENT FROM INTERNALLY ADMINISTERED RADIONUCLIDES, (2) DISTRIBUTION AND RETENTION OF RADIONUCLIDES IN PATIENTS, AND (3) BIOLOGIC EFFECTS OF RADIONUCLIDES.

11-6-4-482 LEUKEMIA AND THYROID CARCINOMA - A COMPARISON OF THE LATE MORTALITY RISKS FROM REACTOR ACCIDENTS
OTWAY, H. J. + ERDMANN, R. C.
LOS ALAMOS SCIENTIFIC LABORATORY, LOS ALAMOS, NEW MEXICO - UCLA, LOS ANGELES, CALIFORNIA
THE LITERATURE REGARDING THE LATE SOMATIC EFFECTS OF IONIZING RADIATION WAS REVIEWED AND ESTIMATES WERE MADE OF THE MORTALITY RISK FOR LEUKEMIA AND THYROID CARCINOMA BASED ON A LINEAR THEORY OF CARCINOGENESIS. THE ESTIMATES WERE ONE DEATH PER MILLION PERSONS PER RAD OF IODINE-131 THYROID IRRADIATION AND 30 DEATHS PER MILLION PERSONS PER RAD FROM LEUKEMIA DUE TO WHOLE-BODY IRRADIATION. THESE NUMBERS ARE APPLIED TO THE DOSE-DISTANCE RELATIONS FOR HYPOTHETICAL DESIGN ACCIDENTS CALCULATED FOR PRESSURIZED-WATER AND FAST BREEDER REACTORS. IT IS CONCLUDED THAT FOR THESE POSTULATED ACCIDENTS AND REACTOR TYPES THE LONG-TERM RISK OF DEATH FROM LEUKEMIA MAY BE COMPARABLE TO OR GREATER THAN THAT FROM THYROID CARCINOMA.

11-6-5-493 REPORT ON SEMINAR OF TRIGA OWNERS
KRAKER, P.
U.S. DEPARTMENT OF THE INTERIOR, DENVER, COLORADO
A SEMINAR OF TRIGA RESEARCH-REACTOR OWNERS WAS HELD IN DENVER, COLO., IN FEBRUARY 1970. SOME OF THE REMARKS, OPINIONS, AND INFORMATION FROM THE SESSIONS ARE ASSEMBLED AND PUBLISHED IN THIS ARTICLE UNDER THE FOLLOWING HEADINGS - REACTOR FUNDING, TECHNICAL SPECIFICATIONS AND REACTOR LICENSING, TRIGA FUEL ELEMENTS, TRIGA REACTOR DESIGN IMPROVEMENTS, TRIGA EXPERIENCES, HEALTH-PHYSICS CONSIDERATIONS, AND TRIGAS AND USAEC COMPLIANCE.

12-1-1-001 RADIATION STANDARDS AND PUBLIC HEALTH
EISENBUD, M.
NEW YORK UNIVERSITY MEDICAL CENTER, NEW YORK, NEW YORK
THE RADIATION SAFETY RECORD OF THE AEC HAS BEEN GOOD, BUT CHANGES IN THE PRESENT REGULATORY SYSTEM ARE NEEDED TO RECONCILE DIFFERENCES BETWEEN PUBLIC ATTITUDES AND THE AEC. AEC REGULATIONS ARE BASED ON THE RECOMMENDATIONS OF THE ICRP AND THE NCRP, AND THE STANDARDS CONTAIN EXTENSIVE BUILT-IN CONSERVATISM. HOWEVER, THE EMPHASIS ON THE MAXIMUM PERMISSIBLE CONCENTRATIONS OF RADIONUCLIDES IN AIR AND DRINKING WATER SHOULD BE CHANGED TO SPECIFY THE MAXIMUM PERMISSIBLE DAILY INTAKE FROM ALL SOURCES TO TAKE INTO CONSIDERATION MULTIPLE SOURCES AND ECOLOGICAL FACTORS. FURTHER, THE DUAL RESPONSIBILITY OF THE AEC FOR THE DEVELOPMENT OF NUCLEAR POWER AND THE PROTECTION OF THE PUBLIC HAS CONTRIBUTED TO LACK OF PUBLIC CONFIDENCE IN THE AEC. ACCORDINGLY IT IS RECOMMENDED THAT RESPONSIBILITIES FOR SETTING RADIATION LIMITS BE SHIFTED TO ANOTHER AGENCY OF THE FEDERAL GOVERNMENT. THE SAME AGENCY, IN COOPERATION WITH THE STATES, SHOULD ASSUME RESPONSIBILITY FOR ENVIRONMENTAL MONITORING IN THE VICINITY OF AEC-LICENSED FACILITIES.

12-1-2-009 OFFSHORE SITING OF NUCLEAR ENERGY STATIONS
ANDERSON, T. D.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
QUESTIONS INVOLVING ENVIRONMENTAL QUALITY, PRIORITY OF LAND USES, AND PUBLIC SAFETY HAVE CREATED AND WILL CONTINUE TO CREATE DIFFICULTIES IN FINDING ACCEPTABLE SITES FOR NUCLEAR POWER PLANTS. INTEREST IS INCREASING IN OFFSHORE STATIONS AS ONE SOLUTION TO THE SITING PROBLEM. INVESTIGATIONS OF OFFSHORE STATIONS HAVE INCLUDED BOTH ARTIFICIAL ISLANDS AND FLOATING PLATFORMS AND HAVE TOUCHED ON ENVIRONMENTAL EFFECTS, ECONOMICS, AND SAFETY. INDICATIONS ARE THAT MANY OF THE PROBLEMS ASSOCIATED WITH SITING NUCLEAR POWER PLANTS COULD BE ALLEVIATED BY OFFSHORE STATIONS. THE FLOATING-STATION CONCEPT, IN PARTICULAR, SEEMS TO HAVE SIGNIFICANT POTENTIAL FOR THE FUTURE. BEFORE THIS POTENTIAL CAN BE REALIZED, HOWEVER, CONSIDERABLE DEVELOPMENT OF THE CONCEPT WILL BE NEEDED.

12-1-3-015 PLUME RISE - A RECENT CRITICAL REVIEW
BRIGGS, G. A.
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, OAK RIDGE TENNESSEE
COMPARISONS OF A LARGE NUMBER OF PLUME-RISE OBSERVATIONS AND FORMULAS INDICATED THAT A RELATIVELY SIMPLE MODEL PROVIDED THE BEST PREDICTIONS OF PLUME RISE IN A VARIETY OF METEOROLOGICAL CONDITIONS. THE MODEL PREDICTS THAT NEAR THE STACK THE RISE OF A HOT, BUOYANT PLUME IS PROPORTIONAL TO THE RECIPROCAL OF THE WIND SPEED, TO THE ONE-THIRD POWER OF THE HEAT EMISSION, AND TO THE TWO-THIRDS POWER OF THE DISTANCE DOWNWIND. THIS '2/3 LAW' OF RISE FITS THE BULK OF PUBLISHED OBSERVATIONS. DEPENDENCE ON DISTANCE DOWNWIND GRADUALLY DIMINISHES IN NEUTRAL ATMOSPHERIC CONDITIONS BEYOND THE DISTANCE RELATED TO THE HEAT EMISSION AND THE STACK HEIGHT. IN STABLE CONDITIONS, RATHER ABRUPT LEVELING OF PLUMES OCCURS AT A DISTANCE DEPENDENT ON THE WIND SPEED AND THE ATMOSPHERIC VERTICAL TEMPERATURE GRADIENT. THE MODEL WAS ALSO APPLIED TO THE PREDICTION OF WHETHER A HOT PLUME WILL PENETRATE AN ELEVATED INVERSION AND WAS FOUND TO AGREE WITH OBSERVATIONS.

12-1-3-025 ECOLOGICAL CONSIDERATIONS IN SITING NUCLEAR POWER PLANTS - THE LONG TERM BIOTIC EFFECTS PROBLEM
AUERBACH, S. I.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
ONE OF THE CURRENT CONCERNS OVER THE INCREASING INSTALLATION OF NUCLEAR POWER STATION IS THE POTENTIAL IMPACT OF RADIOACTIVE WASTE RELEASES ON LOCAL ECOSYSTEMS. IN PARTICULAR, THE QUESTION HAS BEEN RAISED WHETHER WASTE RELEASES AT MAXIMUM PERMISSIBLE CONCENTRATION (MPC) LEVELS WOULD CAUSE ECOLOGICAL PROBLEMS DUE TO THE RADIOACTIVITY. HYPOTHETICAL ANNUAL SUBMERSION DOSE RATES FROM WATER ASSUMED TO BE MAINTAINED AT THE OCCUPATIONAL MPC X 1/30 WERE CALCULATED FOR ORGANISMS LIVING CONTINUOUSLY IN THESE WATERS. THESE HYPOTHETICAL DOSES ARE USED AS A BASIS FOR COMPARISONS IN A VARIETY OF ECOLOGICAL STUDIES OF LOW DOSES OF IONIZING RADIATION AND ARE ANALYZED AND EVALUATED IN TERMS OF DETECTABILITY OF BIOLOGICAL EFFECTS AT MPC LEVELS. PRESENT KNOWLEDGE BASED ON THESE AND SIMILAR STUDIES OF THE ECOLOGICAL EFFECTS OF LOW-LEVEL CHRONIC DOSES, SUCH AS COULD RESULT FROM ROUTINE REACTOR RELEASES UNDER CURRENT STANDARDS, GUIDELINES, AND OPERATIONAL EXPERIENCE, INDICATES THAT ANY POSSIBLE BIOLOGICAL EFFECTS WOULD BE UNDETECTABLE. ALTHOUGH THE DATA IN SUPPORT OF THIS CONTENTION ARE LIMITED, THEY CONSISTENTLY POINT TO THIS CONCLUSION.

12-1-4-035 FUEL MELTDOWN AT ST. LAURENT I
CORBETT, B. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE ST. LAURENT I PLANT, ELECTRICITE DE FRANCE'S NEW 500-MW(E) GAS-COOLED NUCLEAR GENERATING FACILITY, SUFFERED A FUEL MELTDOWN ON OCT. 17, 1969. DURING A ROUTINE REFUELING OPERATION, GRAPHITE ABSORBERS, INCLUDING A GRAPHITE FLOW RESTRICTOR, WERE MISTAKENLY LOADED AT THE TOP OF A FUEL ELEMENT CHANNEL. THE COOLANT-FLOW REDUCTION DAMAGED 6 OF THE 10 FUEL ELEMENTS IN THIS CHANNEL, AND THERE WAS SOME EVIDENCE THAT UP TO 10 KG OF URANIUM (EQUIVALENT TO A COMPLETE FUEL ELEMENT) COMPLETELY MELTED. SUBSEQUENT CLEANUP AND PLANT MODIFICATIONS WERE EXPECTED TO REQUIRE ABOUT 1 YEAR OF REACTOR DOWNTIME.

12-2-1-75 THE IAEA-AEC SYMPOSIUM ON ENVIRONMENTAL ASPECTS OF NUCLEAR POWER
GIFFORD, F. A., JR.
AIR RESOURCES ATMOSPHERIC TURBULENCE AND DIFFUSION LABORATORY, OAK RIDGE, TENNESSEE
A SYMPOSIUM ON ENVIRONMENTAL ASPECTS OF NUCLEAR POWER STATIONS WAS HELD IN NEW YORK CITY, AUG.10-14,1970. THE PRINCIPAL TOPICS CONSIDERED WERE NUCLEAR POWER AS AN ENERGY SOURCE, STANDARDS FOR THE CONTROL OF EFFLUENTS, EFFLUENT CONTROL AND MONITORING, CONSIDERATIONS AFFECTING STEAM POWER-STATION SITE SELECTION, AND BENEFIT VS. RISK ASSESSMENT.

12-2-1-83 AN APPRECIATION OF FAST REACTOR SAFETY-1970
RASMUSSEN, N. C.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASSACHUSETTS
THIS UKAEA REPORT CONCISELY SUMMARIZES CURRENT THINKING IN THE UNITED KINGDOM WITH REGARD TO FAST REACTOR SAFETY - SPECIFICALLY, SODIUM-COOLED FAST REACTOR SAFETY. THE PRINCIPAL PURPOSE OF THE REPORT IS STATED, AS FOLLOWS, BY F. R. FARMER IN THE FOREWORD - IT IS IMPORTANT FOR ALL COUNTRIES THAT FAST REACTORS SHOULD BE SAFE AND THAT SAFETY SHOULD NOT BE A MATTER OF COMMERCIAL BARGAINING. THE IMMEDIATE NEED NOW IS TO DEVELOP A COMMON INSIGHT INTO THE TECHNICAL UNCERTAINTIES OF FAST REACTORS, FROM WHICH MAY EVOLVE A SAFETY PHILOSOPHY WHICH CAN BE MEANINGFULLY PURSUED BY ALL COUNTRIES. THERE IS STILL NEED FOR MORE WORK AND IN THE BELIEF THAT PROBLEMS OF ALL MAJOR SYSTEMS REQUIRE INTERNATIONAL RECOGNITION AND JOINT EFFORT IN THEIR SOLUTION, THIS COMPENDIUM IS OFFERED IN THE HOPE THAT THE COMMENT AND CRITICISM IT MIGHT EVOKE COULD LEAD TO A SECOND IMPROVED VERSION WITH CONTRIBUTIONS FROM OTHER NATIONS.

12-2-2-85 RESTRICTED RELEASE OF PLUTONIUM I. OBSERVATIONAL DATA
HUNT, D. C.
DOW CHEMICAL COMPANY, GOLDEN, COLORADO
A STUDY WAS MADE OF THE POSSIBLE HAZARD OUTSIDE AN ENCLOSURE DUE TO INCIDENTAL RELEASE FROM THE ENCLOSURE FOLLOWING THE UNCONTROLLED RELEASE OF PLUTONIUM WITHIN THE ENCLOSURE BY REVIEWING THE EXISTING OBSERVATIONAL DATA ON SUCH RESTRICTED PLUTONIUM RELEASES. OBSERVATIONS BASED ON BOTH ACCIDENT EXPERIENCE AND EXPERIMENTS DESIGNED TO STUDY THE RESTRICTED RELEASE WERE CONSIDERED. THE CONCLUSION BASED ON THE OBSERVATIONAL DATA IS THAT RESTRICTED RELEASE IS UNLIKELY TO LEAD TO DANGEROUS FREE RELEASE OF A PLUTONIUM AEROSOL. A REMARKABLE EXAMPLE OF THIS WAS THE FIRE AT THE ROCKY FLATS PLANT ON MAY 11,1969. ONLY A MINUTE AMOUNT OF THE PLUTONIUM INVOLVED IN THE FIRE ESCAPED FROM THE BUILDING IN WHICH THE FIRE OCCURRED, AND NO PLUTONIUM WAS DETECTED BEYOND THE PLANT BOUNDARIES.

12-2-3-90 FISSION PRODUCT DETECTION SYSTEMS IN HIGH TEMPERATURE GAS-COOLED REACTORS
BAUMANN, C. D.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
AN APPLICATIONS STUDY IS MADE OF RADIATION MEASURING INSTRUMENTS AND SYSTEMS THAT MIGHT BE SUITABLE FOR DEVELOPMENT AS MONITORS OF THE FISSION PRODUCT ACTIVITY OF THE PRIMARY GAS-COOLANT STREAM IN HIGH TEMPERATURE GAS-COOLED REACTORS. PARTICULAR ATTENTION IS GIVEN TO THE PLATEOUT IN LOOP COMPONENTS, PRIMARILY THE HEAT EXCHANGERS. THE DETECTORS REVIEWED ARE IONIZATION CHAMBERS, BETA AND GAMMA SPECTROMETERS, CHARGED-WIRE PRECIPITATORS, CERENKOV DETECTORS, FILTERS, DIFFUSION TUBES, THERMAL-GRADIENT TUBES, DEPOSITION TUBES, AND IMPACTORS. THE PRINCIPLE OF OPERATION OF EACH IN A SYSTEM IS DESCRIBED, AND THE ADVANTAGES AND DISADVANTAGES IN APPLICATION TO THE PROBLEM ARE EVALUATED. ON THE BASIS OF LINER PENETRATION REQUIREMENTS, GAS STREAM SAMPLING TECHNIQUES, CONCURRENCY OF READOUT, AND THE CHARACTERISTIC MERITS OF THE INDIVIDUAL SYSTEMS, IT APPEARS THAT THE DEPOSITION TUBE AND GAMMA SPECTROMETER SYSTEMS CAN BE FURTHER DEVELOPED AS COMPETENT PLATEOUT MONITORS FOR HIGH TEMPERATURE GAS LOOPS IN NUCLEAR REACTOR SERVICE.

12-2-4-100 THE ELEVENTH AEC AIR CLEANING CONFERENCE
MOELLER, D. W.
HARVARD UNIVERSITY, BOSTON, MASSACHUSETTS
THE ELEVENTH AEC AIR-CLEANING CONFERENCE WAS HELD AUG.31-SEPT.3,1970, IN RICHLAND, WASH. THE SUBJECTS DISCUSSED WERE (1) SODIUM AEROSOLS FROM LIQUID METAL-COOLED FAST BREEDER REACTORS (2) WATER-REACTOR FISSION PRODUCT RELEASE ESTIMATIONS (3) REMOVAL AND BEHAVIOR OF FISSION PRODUCT GASES (4) IODINE CHARACTERIZATION AND REMOVAL (5) OTHER FILTRATION STUDIES (6) INSTRUMENT DEVELOPMENT AND EVALUATION (7) EFFECTS OF AIRBORNE RADIOACTIVE MATERIALS (8) FIRE SAFETY AND (9) STANDARDS DEVELOPMENT. THE PROCEEDINGS OF THE CONFERENCE WERE PUBLISHED IN JANUARY 1971.

12-2-5-110 PREDICTING SEA-BREEZE FUMIGATION FROM TALL STACKS AT COASTAL LOCATIONS
COLLINS, G. F.
THE RESEARCH CORPORATION OF NEW ENGLAND, HARTFORD, CONNECTICUT
A METHOD OF PREDICTING THE TRANSPORT DISTANCE REQUIRED TO COMPLETE THE TRANSITION FROM OVERWATER TO OVERLAND DIFFUSION AS A FUNCTION OF PLUME HEIGHT, WIND SPEED, AND VERTICAL TEMPERATURE PROFILE WAS SUGGESTED BY ISAAC VAN DER HOVEN IN NUCLEAR SAFETY FOR SEPT.-OCT.1967. THIS ARTICLE DESCRIBES FIELD STUDIES CONDUCTED ON THE SHORES OF CAPE COD BAY DURING THE SUMMER OF 1969 TO TEST THE ACCURACY OF VAN DER HOVEN'S TECHNIQUE AND ITS APPLICABILITY TO IRREGULAR TERRAIN. THE RESULTS OF THE STUDY SHOW THAT THE METHOD OFFERS A PRACTICAL TOOL FOR COMPILING A SEA-BREEZE FUMIGATION CLIMATOLOGY.

12-2-5-114 METEOROLOGICAL EFFECTS OF THE HEAT AND MOISTURE PRODUCED BY MAN
HANNA, S. R. + SWISHER, S. D.
AIR RESOURCES ATMOSPHERIC TURBULENCE AND DIFFUSION LABORATORY, OAK RIDGE, TENNESSEE
INTERACTIONS AMONG THE HEAT AND MOISTURE PRODUCED BY MAN AND ALL SCALES OF ATMOSPHERIC PHENOMENA ARE BEING STUDIED IN LIGHT OF CURRENT OBSERVATIONS AND FUTURE PROJECTIONS OF ENERGY CONSUMPTION. ATMOSPHERIC PROCESSES ARE NOW BEING SIGNIFICANTLY INFLUENCED ON LENGTH SCALES UP TO ABOUT 20 KM, A FIGURE THAT IS LIKELY TO INCREASE AS ENERGY PRODUCTION INCREASES. PRESENT RESEARCH EFFORTS ON THESE ATMOSPHERIC INTERACTIONS ARE INSUFFICIENT AND PROGRAMS TO SUPPLEMENT THESE ARE NEEDED.

12-2-6-123 FUEL MELTING INCIDENT AT THE FERMI REACTOR ON OCT.5,1966
SCOTT, R. L., JR.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
ON OCT.5,1966, THE ENRICO FERMI 1 NUCLEAR REACTOR SUSTAINED THE PARTIAL MELTDOWN OF TWO FUEL SUBASSEMBLIES AS THE RESULT OF COOLANT FLOW BLOCKAGE. IT WAS DETERMINED THAT A COMPONENT WITHIN THE REACTOR VESSEL HAD VIBRATED LOOSE AND CAUSED FLOW BLOCKAGE WHEN HYDRODYNAMIC FORCES CARRIED IT UP TO THE INLET NOZZLE OF THE FUEL SUBASSEMBLIES. RECOVERY OPERATIONS WERE SUCCESSFUL AND WERE CLIMAXED BY FULL POWER OPERATION AT 200 MW(T) (65 MW(E)) ON OCT.16,1970. MANY REPORTS AND ARTICLES HAVE BEEN WRITTEN ABOUT THE INCIDENT DURING THE PAST 4 YEARS, BUT MOST OF THESE WERE FRAGMENTARY BECAUSE THE INVESTIGATIONS AND ANALYSES HAD NOT BEEN COMPLETED. THIS REVIEW WAS PREPARED TO PRESENT A CONCISE DESCRIPTION OF THE INCIDENT AND SUMMARY OF THE RESULTS OF THE INVESTIGATIONS. THE SEQUENCE OF EVENTS LEADING UP TO THE INCIDENT AND DURING THE INCIDENT IS REVIEWED. THE CONSIDERATIONS THAT LED TO UNDERSTANDING WHAT HAD TRANSPIRED ARE PRESENTED, AND THE LESSONS DERIVED FROM THE INCIDENT ARE DISCUSSED.

12-2-6-134 REPORT ON THE 1970 ANS CONFERENCE ON POWER REACTOR SYSTEMS AND COMPONENTS
SCOTT, R. L., JR.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
FIFTY-THREE PAPERS WERE PRESENTED AT THE AMERICAN NUCLEAR SOCIETY'S 1970 CONFERENCE ON POWER REACTOR SYSTEMS AND COMPONENTS. THE PAPERS COVERED THE MAIN SUBJECT AREAS OF QUALITY ASSURANCE, SAFETY AND INSTRUMENTATION SYSTEMS, COMMERCIAL REACTORS, AND ADVANCED REACTORS. SOME OF THE MORE INTERESTING AND INFORMATIVE ASPECTS OF THE PAPERS INCLUDED STARTUP EXPERIENCES AT A COMMERCIAL NUCLEAR POWER PLANT, REVIEWS OF THE NUCLEAR STANDARDS PROGRAMS IN THE UNITED STATES, RESULTS OF LOSS-OF-COOLANT ACCIDENT STUDIES, AND RESULTS OF A SIMULATED ACCIDENT IN AN ACTUAL CONTAINMENT STRUCTURE.

12-3-1-185 RADIATION IN PERSPECTIVE - SOME COMPARISONS OF THE ENVIRONMENTAL RISKS FROM NUCLEAR AND FOSSIL FUELED POWER PLANTS
HULL, A. P.
BROOKHAVEN NATIONAL LABORATORY, UPTON, L.I., NEW YORK
FOSSIL AND NUCLEAR FUELED STEAM PLANTS SEEM THE PRACTICAL MEANS FOR MEETING IMMEDIATE POWER NEEDS. THE USE OF NUCLEAR FUELED PLANTS IS BEING RESTRICTED IN SEVERAL INSTANCES BECAUSE REACTOR RELATED HAZARDS HAVE BEEN EXAGGERATED. NINETY POWER REACTORS, IN THE UNITED STATES AND ABROAD, HAVE GENERATED 2.5 X 10(EXP11) KWH OVER 650 REACTOR YEARS WITHOUT SERIOUS INCIDENTS. COMPARISON OF ROUTINE DISCHARGES OF HAZARDOUS AGENTS FROM DIFFERENT TYPES OF STEAM POWER PLANTS SHOWS THAT NUCLEAR FUELED PLANTS PRODUCE THE LOWEST CONCENTRATIONS OF SUCH AGENTS RELATIVE TO PROTECTION STANDARDS. RADIOACTIVE RELEASES ASSOCIATED WITH THE BROOKHAVEN GRAPHITE RESEARCH REACTOR

ARE COMPARABLE TO THE UPPER AMOUNTS ANTICIPATED FROM 1000-MW(E) REACTORS, AND THE MEASURED BROOKHAVEN EXTERNAL RADIATION LEVELS, DEPOSITION, AND AQUATIC CONCENTRATIONS SUGGEST THAT THE RADIATION LEVEL IN THE VICINITY OF LARGE POWER REACTORS SHOULD BE INSIGNIFICANT. THE CALCULATED RISK (ABOUT 10(EXP-7)/YEAR) OF FATAL INJURY FROM THE ANTICIPATED MAXIMUM EXPOSURES OF A FEW MILLIREMS PER YEAR ABOVE NATURAL BACKGROUND IS SMALL COMPARED WITH THAT OF OTHER ACCEPTED HAZARDS OF EVERYDAY LIVING.

12-3-1-196 CREST SUMMARY - WATER-COOLED REACTOR SAFETY
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE COMMITTEE ON REACTOR SAFETY TECHNOLOGY OF THE ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT HAS PUBLISHED AN ASSESSMENT OF WATER-COOLED REACTOR SAFETY. THIS ASSESSMENT SUMMARIZES OVER 3 YEARS OF EFFORT BY A WORKING GROUP OF SOME OF THE MOST QUALIFIED EUROPEAN NUCLEAR SAFETY EXPERTS. FOR THE PURPOSES OF THIS REPORT, THE SCOPE OF WORK IS DIVIDED INTO EIGHT AREAS, AND IN EACH AREA, TO THE EXTENT PRACTICAL, THE PROBLEM IS DEFINED, ANALYTICAL METHODS ARE SURVEYED, AVAILABLE EXPERIMENTAL AND THEORETICAL PROGRAMS ARE EVALUATED, AND THE EFFECTS ON ACCIDENT ANALYSIS ARE NOTED. THE EIGHT AREAS SO COVERED INCLUDE (1) THERMOHYDRAULIC EFFECTS OF BLOWDOWN (2) EMERGENCY CORE COOLING (3) BEHAVIOR OF MOLTEN CORE MATERIALS (4) MISSILE EFFECTS ON CONTAINMENT, PIPES, AND COMPONENTS (5) CONTAINMENT SYSTEM RESPONSE (6) FISSION PRODUCT RELEASE, TRANSPORT, AND REMOVAL (7) RELIABILITY ANALYSIS IN REACTOR DESIGN AND SAFETY ASSESSMENT AND (8) POWER TRANSIENTS CAUSED BY REACTIVITY ADDITION.

12-3-2-203 RESTRICTED RELEASE OF PLUTONIUM II. THEORY
HUNT, D. C.
THE DOW CHEMICAL COMPANY, GOLDEN, COLORADO
A STUDY WAS MADE OF THE POSSIBLE HAZARD OUTSIDE AN ENCLOSURE DUE TO UNCONTROLLED RELEASE OF PLUTONIUM WITHIN THE ENCLOSURE. IN PART 1 OF THIS STUDY, WHICH WAS PUBLISHED IN NUCLEAR SAFETY, VOL. 12, NO. 2, A REVIEW WAS MADE OF EXISTING OBSERVATIONAL DATA ON SUCH RESTRICTED PLUTONIUM RELEASES. IN THIS SECOND AND LAST PART OF THE STUDY, A MODEL OF RESTRICTED RELEASE IS DEVELOPED. THE MODEL PREDICTS 'FREE-RELEASE' SOURCE STRENGTHS AS A FUNCTION OF THE VARIABLES ASSUMED TO DESCRIBE THE RELEASE. AN ILLUSTRATION OF THE USE OF THE THEORETICAL METHODS IS GIVEN BY APPLYING THEM TO THE ROCKY FLATS CRITICAL MASS FACILITY TEST CELL. THESE PARTICULAR CALCULATIONS SHOW THAT THE ACTUAL RELEASE WOULD BE SIGNIFICANTLY LESS THAN THE ALLOWABLE PLUTONIUM-239 MPC VALUE FOR INSOLUBLE MATERIAL IN CONTROLLED AREAS IF NOMINAL VALUES ARE ASSUMED FOR ALL RELEASE PARAMETERS. A PARAMETRIC STUDY INDICATED THAT THE CALCULATED RESULTS ARE MOST SENSITIVE TO THE RATE OF RELEASE OF PLUTONIUM WITHIN THE ENCLOSURE AND TO THE ASSUMED THERMAL EQUILIBRIUM CONDITIONS WITHIN THE ENCLOSURE.

12-3-3-217 REVIEW OF ENGINEERING STANDARDS DEVELOPMENT FOR NUCLEAR POWER SYSTEMS
JOSLIN, W. M. + MOORE, J. S. + HUSS, J. C.
AMERICAN NATIONAL STANDARDS INSTITUTE, OAK PARK, ILLINOIS - WESTINGHOUSE ELECTRIC CORPORATION, PITTSBURGH, PENNSYLVANIA - GENERAL ELECTRIC COMPANY, SAN JOSE, CALIFORNIA
THE EFFORTS BEING MADE BY THE AMERICAN NATIONAL STANDARDS INSTITUTE, INC., THE AMERICAN NUCLEAR SOCIETY, AND THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS IN PROMOTING ENGINEERING STANDARDS DEVELOPMENT PROGRAMS FOR NUCLEAR POWER SYSTEMS ARE DISCUSSED BY THREE LEADERS IN THE FIELD. SOME EXAMPLES ARE GIVEN OF THE DIFFICULTIES AND THE SATISFACTIONS, AND SOME SUGGESTIONS ARE MADE FOR SOLVING THE PROBLEMS. THE REVIEWERS PRESENT A GENERAL CONCLUSION THAT THE TIME ELAPSE FROM INCEPTION TO ADOPTION NEEDS TO BE SHORTENED AND THAT MORE PARTICIPATION AND CLOSER COORDINATION ARE NEEDED AMONG GROUPS HAVING OVERLAPPING INTERESTS.

12-3-3-226 THE USE OF ACTUATORS AS LOGIC ELEMENTS IN RELATION TO FAIL SAFE DESIGN
EPLER, E. P. + DITTO, S. J.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
SOME OF THE PRINCIPLES GOVERNING CURRENT DESIGNS OF ELECTRICAL OR ELECTRONIC VOTING LOGIC SYSTEMS CAN BE APPLIED TO THE DESIGN OF CONTROL AND PROTECTION SYSTEMS WHERE THE VOTING LOGIC IS AT THE LEVEL OF THE LARGE ELECTROMECHANICAL DEVICES THAT ACT DIRECTLY TO CONTROL A PROCESS. THIS APPLICATION IS OF PARTICULAR BENEFIT IN SYSTEMS FOR WHICH THERE MAY BE A SIGNIFICANT PENALTY FOR FAILURE IN THE SO-CALLED SAFE MODE AS WELL AS IN THE UNSAFE MODE. SUCH SYSTEMS HAVE FREQUENTLY MADE USE OF 'FAILURE-TO-DANGER' TECHNIQUES, WHICH IN SOME AREAS MIGHT LEAD TO A COMPROMISE OF SAFETY OBJECTIVES. THE USE OF ACTUATORS AS LOGIC ELEMENTS ALLOWS THE DESIGN OF SIMPLER SYSTEMS, WITH MORE COMPLETE TESTABILITY, AND CAN PROVIDE AN ULTIMATE GAIN IN SAFETY.

12-3-4-234 NUCLEAR SAFETY IN AMERICAN RADIOCHEMICAL PROCESSING PLANTS
UNGER, W. E. + BROWDER, F. N. + MANN, S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
WITH THE PROJECTED RAPID GROWTH OF NUCLEAR ELECTRIC POWER GENERATION AND THE ACCOMPANYING GROWTH IN REPROCESSING OF SPENT NUCLEAR FUEL, THE WHOLE AREA OF NUCLEAR AND RADIOCHEMICAL SAFETY BECOMES INCREASINGLY IMPORTANT. THERE IS AN INDICATED WORLDWIDE NEED FOR INFORMATION ON ACCEPTED PRACTICES, RECOMMENDED METHODS, AND REGULATIONS FOR SAFE OPERATION IN RADIOCHEMICAL PROCESSING PLANTS. EXPERIENCE AND DEVELOPMENTS IN THE UNITED STATES ARE DESCRIBED TO ILLUSTRATE SAFETY CONSIDERATIONS IN ALL STAGES FROM SITE SELECTION AND LICENSING THROUGH DESIGN, CONSTRUCTION, AND OPERATION AND MAINTENANCE OF PROCESSING PLANTS.

12-4-1-283 NUCLEAR POWER IN PERSPECTIVE - THE PLIGHT OF THE BENIGN GIANT
HESS, D. N.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
PREMISED ON THE ASSUMPTION THAT THE PUBLIC PRESS IS BOTH A MOLDER OF OPINION AND A REFLECTOR OF PUBLIC INTEREST AND CRITIQUE, NEARLY 800 ITEMS IN THE DAILY AND PERIODICAL PRESS PERTAINING TO THE NUCLEAR INDUSTRY AND COVERING A PERIOD OF ABOUT 1 YEAR WERE EXAMINED FOR THEIR PHILOSOPHICAL AND PSYCHOLOGICAL IMPACT ON THE READER. ACCORDINGLY THIS SURVEY IS A RETROSPECTIVE ASSESSMENT IN ORDER OF PRIORITY OF THE PRINCIPAL CONTROVERSIAL ISSUES CONFRONTING THE NUCLEAR COMMUNITY. THE HOPE IS THAT, FROM THIS WORK, NUCLEAR ADVOCATES AND ALLIED INTERESTS MAY FIND A FIRMER SENSE OF DIRECTION AND SIGNIFICANT AREAS WHERE SPECIAL ATTENTION CAN BE MOST PROFITABLY DEVOTED TO AFFORD THE PUBLIC THE REASSURANCES IT NEEDS TO FEEL AT EASE IN THE PRESENCE OF THE ENERGY GIANT.

12-4-1-291 NUCLEAR LIABILITY INSURANCE - A BRIEF HISTORY REFLECTING THE SUCCESS OF NUCLEAR SAFETY
MARRONE, J.
NUCLEAR ENGINEERING LIABILITY INSURANCE AGENCY, NEW YORK, NEW YORK
NUCLEAR LIABILITY INSURANCE HAS BEEN MADE AVAILABLE TO THE NUCLEAR INDUSTRY BY AMERICAN INSURERS THROUGH POOLING ARRANGEMENTS THAT DISTRIBUTE THE RISK AMONG MANY PARTICIPATING INSURERS. THE LIABILITY INSURANCE AFFORDED BY THE POOLS HAS THUS FAR BEEN THE ONLY MEANS EMPLOYED TO SATISFY THE FINANCIAL PROTECTION REQUIREMENTS IMPOSED BY THE AEC ON SOME OF ITS LICENSEES. THE EXTRAORDINARY SAFETY RECORD OF THE NUCLEAR INDUSTRY IS QUITE VISIBLE IN THE POOLS' LIABILITY CLAIMS EXPERIENCE. THE MOST SIGNIFICANT FACT ISSUING FROM 14 YEARS OF OPERATION IS THAT THE NUCLEAR LIABILITY POOLS HAVE NEVER RECEIVED A CLAIM FOR BODILY INJURY OR PROPERTY DAMAGE CAUSED DURING THE OPERATION OF A LICENSED NUCLEAR REACTOR - THIS INCLUDES ALL TYPES OF LICENSED REACTORS. CRITICS OF NUCLEAR SAFETY HAVE PLAYED A ROLE IN ACHIEVING THIS RECORD. THE LIABILITY LOSS EXPERIENCE OF THE NUCLEAR INDUSTRY SUGGESTS THAT A POSITIVE IMAGE OF SAFETY IN THE NUCLEAR INDUSTRY COULD BE PROJECTED BY PRESENTING IT AS AN EXAMPLE, WARRANTING EMULATION, OF EFFECTIVE CONTROL OF A RELATIVELY NEW AND SERIOUS HAZARD. THAT OVER 1 MILLION PERSONS HAVE BEEN KILLED IN CONVENTIONAL ACCIDENTS IN THE UNITED STATES IN THE 10-YEAR PERIOD 1960 TO 1969 STRONGLY SUGGESTS THAT MUCH COULD BE LEARNED FROM THE NUCLEAR SAFETY PROGRAM BY THOSE WHO ARE CONCERNED ABOUT SAFETY IN THE NONNUCLEAR AREA.

12-4-2-297 FISSION GAS EFFECTS IN REACTOR FUELS I. BASIC STUDIES
CAFROLL, R. M.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE LITERATURE DEALING WITH THE BASIC PROCESSES OF FISSION-GAS BEHAVIOR IN REACTOR FUEL MATERIALS WHICH WAS PUBLISHED BETWEEN 1968 AND THE FALL OF 1970 IS REVIEWED. PARTICULAR ATTENTION IS CALLED TO THE 85 PUBLICATIONS CITED, AND NO ATTEMPT IS MADE TO PROVIDE A COMPREHENSIVE SUMMARY OF THEM. A CONSISTENT PATTERN IS SHOWN FOR ALL THE FUELS STUDIED. FISSION GAS WITHIN THE FUEL MATRIX DIFFUSES RAPIDLY EVEN AT COMPARATIVELY LOW TEMPERATURES. HOWEVER, THE GAS IS ATTACHED TO TRAPPING SITES WITH A FORCE THAT DEPENDS ON THE NATURE OF THE SITE AND THE NUMBER OF GAS ATOMS COLLECTED AT THE SITE. VARIOUS DRIVING FORCES CAN DISLODGE THE GAS ATOMS FROM THE SITE, AND NEW SITES CAN BE CREATED BY IRRADIATION. THUS GAS BEHAVIOR DURING FISSIONING DEPENDS ON VARIOUS TRAPPING AND DRIVING FORCES.

12-4-2-305 RISK MINIMIZATION BY OPTIMUM ALLOCATION OF RESOURCES AVAILABLE FOR RISK REDUCTION
RIVARD, J. B.
SANDIA LABORATORIES, ALBUQUERQUE, NEW MEXICO
A QUANTITATIVE APPROACH TO SYSTEM SAFETY HAS BEEN DEVELOPED. THE RISKS FROM COMPONENT ACTIVITIES ARE EXPRESSED AS EXPLICIT FUNCTIONS OF THE RESOURCES AVAILABLE FOR THEIR REDUCTION, AND THE MINIMUM SYSTEM RISK IS THEN FOUND BY DYNAMIC PROGRAMMING. NUMERICAL EXAMPLES OF THE METHOD ARE GIVEN.

12-4-3-310 JOINT ANNUAL SYMPOSIUM OF IEEE POWER AND NUCLEAR SCIENCE GROUPS - 1970
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE SECOND JOINT SYMPOSIUM BY THE IEEE POWER AND NUCLEAR SCIENCE GROUPS ON THE GENERAL TOPIC OF NUCLEAR POWER, CONTROL, AND INSTRUMENTATION WAS HELD IN NEW YORK CITY, NOV. 3-6, 1970. THE TALKS AND PAPERS PRESENTED TOTALED 121 AT 15 SESSIONS. OF

WHICH TWO WERE TUTORIAL. ENVIRONMENTAL CONSIDERATIONS WERE THE SUBJECT OF THE GENERAL MEETING, AND THE LUNCHEON SPEAKER DEFENDED TECHNOLOGY. THE TECHNICAL SESSIONS COVERED SOME OPERATING EXPERIENCES, RELIABILITY ANALYSES, AND STANDARDS FOR NUCLEAR POWER STATIONS. THERE WERE ALSO PAPERS ON NUCLEAR INSTRUMENTATION FOR RESEARCH AND DEVELOPMENT IN NUCLEAR PHYSICS, BIOMEDICINE, SPACE EXPLORATION, AND DATA COLLECTING.

12-4-4-326 ECOLOGICAL ASPECTS OF TRITIUM BEHAVIOR IN THE ENVIRONMENT
ELWOOD, J. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
A RAPIDLY EXPANDING NUCLEAR POWER ECONOMY HAS RESULTED IN INCREASED PUBLIC CONCERN OVER RELEASES OF RADIONUCLIDES TO THE ENVIRONMENT. REVIEW OF AVAILABLE LITERATURE ON TRITIUM, ONE OF THE RADIONUCLIDES RELEASED TO THE ENVIRONMENT AT NUCLEAR POWER REACTORS AND FUEL REPROCESSING PLANTS, INDICATES THAT TRITIUM CAN BE TAKEN IN BY PLANTS AND ANIMALS AND ORGANICALLY BOUND, REGARDLESS OF THE MEANS OF EXPOSURE. HOWEVER, THERE APPEARS TO BE NO CONCENTRATION FACTOR RELATIVE TO HYDROGEN AT ANY LEVEL OF FOOD CHAINS ANALYZED TO DATE. ISOTOPE EFFECTS APPARENTLY DO NOT SIGNIFICANTLY ALTER TRITIUM BEHAVIOR COMPARED WITH THAT OF STABLE HYDROGEN (HYDROGEN-1) IN NATURAL ECOSYSTEMS. TURNOVER TIMES OF TRITIUM IN COUPLED ECOSYSTEM COMPARTMENTS ARE DEPENDENT ON CLIMATIC, HYDROLOGICAL, AND METEOROLOGICAL FACTORS AND THUS ARE SITE SPECIFIC FOR EACH ECOSYSTEM. HALF-TIMES ARE MUCH LONGER IN A DESERT ECOSYSTEM COMPARED WITH THOSE IN A TROPICAL RAIN FOREST. THE TOTAL ECOSYSTEM WILL HAVE A HALF-TIME OF RETENTION AT LEAST AS LONG AS THE COMPARTMENT WITH THE LONGEST HALF-TIME. TRITIUM BODY BURDEN IS DEPENDENT ON THE PATHWAYS OF EXPOSURE. TISSUE-BOUND FRACTIONS ARISE PRIMARILY FROM ORGANICALLY BOUND TRITIUM IN FOOD. BIOLOGICAL HALF-LIVES OF TISSUE-BOUND FRACTIONS ARE LONGER THAN THE HALF-LIFE OF THE BODY-WATER COMPONENT AND MAY BE AS LONG AS ONE-THIRD OF THE ORGANISM'S LIFE-SPAN. TRITIUM IN ALL COMPARTMENTS IN A CHRONICALLY CONTAMINATED ECOSYSTEM WOULD BE EXPECTED TO BE UNIFORMLY LABELED WITH HYDROGEN-3, WITH THE TRITIUM RATIO BEING DEPENDENT ON RELEASE LEVELS.

12-4-5-338 IAEA - WHO SYMPOSIUM ON HANDLING OF RADIATION ACCIDENTS
ROHWER, P. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
A SYMPOSIUM ENTITLED 'HANDLING OF RADIATION ACCIDENTS' WAS HELD IN VIENNA ON MAY 19-23, 1969. IT WAS ORGANIZED BY THE INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA) AND THE WORLD HEALTH ORGANIZATION (WHO) TO ENABLE RADIATION MONITORING AND DOSIMETRY SPECIALISTS, MEDICAL DOCTORS EXPERIENCED IN DIAGNOSING AND TREATING RADIATION INJURY, NUCLEAR SAFETY AND WASTE MANAGEMENT SPECIALISTS, PUBLIC RELATIONS OFFICERS, AND MANY OTHERS TO DISCUSS RADIATION ACCIDENTS ON A VERY BROAD BASIS. THE LIST OF SESSION TOPICS INDICATES THE SCOPE OF THE SYMPOSIUM - ORGANIZATION AND PLANNING, EARLY ACCIDENT CONTROL MEASURES, MONITORING AND DOSIMETRY, DECONTAMINATION AND PROTECTIVE MEASURES, MEDICAL MANAGEMENT OF EXPOSED OR CONTAMINATED PERSONS, FUTURE EMPLOYMENT OF OVEREXPOSED PERSONS, AND REVIEW OF SELECTED ACCIDENTS. THE AGENDA INCLUDED 55 PAPERS AND A PANEL DISCUSSION ON SYMPOSIUM PROGRAM HIGHLIGHTS AND RECOMMENDATIONS FOR FURTHER WORK RELATIVE TO RADIATION ACCIDENTS. TWO HUNDRED AND TWELVE PARTICIPANTS FROM 34 COUNTRIES AND 9 INTERNATIONAL ORGANIZATIONS PARTICIPATED IN THE SYMPOSIUM. THE PROCEEDINGS OF THE SYMPOSIUM HAVE BEEN PUBLISHED BY THE IAEA AS REPORT STI/PUB/229.

12-5-1-421 LMFBR SAFETY
ROSE, D.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILLINOIS
THIS REVIEW OF LIQUID METAL COOLED FAST BREEDER REACTOR SAFETY EMPHASIZES THE RESEARCH EFFORT AND RECENT RESULTS OF THE MAJOR RESEARCH AND DEVELOPMENT PROGRAMS OF THE U.S. ATOMIC ENERGY COMMISSION AND OF U.S. INDUSTRY. THE SAFETY PROGRAM FOR THE LIQUID METAL COOLED FAST BREEDER REACTOR STRESSES ACCIDENT PREVENTION AND THE EARLY DETECTION AND CONTROL OF POTENTIAL ACCIDENTS. THE MAIN AREAS OF INTEREST INCLUDE THE INVESTIGATION OF FUEL BEHAVIOR AND OF FUEL FAILURE PROPAGATION, THE UNDERSTANDING OF THE PHENOMENA INVOLVED IN REACTIVITY ACCIDENTS AND THE DEVELOPMENT OF TECHNIQUES TO ASSESS THEIR EFFECTS, THE MECHANICAL RESPONSES OF REACTOR SYSTEMS TO ACCIDENTS, AND THE CONTAINMENT OF THE CONSEQUENCES OF POSTULATED ACCIDENTS.

12-5-1-433 LIGHT WATER REACTOR SAFETY
BRIGHT, G. O.
AEROJET NUCLEAR COMPANY, IDAHO FALLS, IDAHO
LIGHT WATER REACTOR SAFETY PROBLEMS ARE PRIMARILY ASSOCIATED WITH THE LARGE POWER REACTORS NOW BEING CONSTRUCTED. CONSIDERATION OF THESE COMPLEX SYSTEMS HAS RESULTED IN THE DEVELOPMENT OF A WATER REACTOR SAFETY PROGRAM PLAN, WHICH REPRESENTS AN INDUSTRY WIDE CONSENSUS ON ISSUES, NEEDS, AND PRIORITIES. THE PRINCIPAL ISSUES ARE IDENTIFIED AS DEVELOPMENT AND CONFIRMATION OF ANALYTICAL TECHNIQUES FOR DESIGN AND SAFETY EVALUATION. SPECIFIC AREAS OF GREATEST IMPORTANCE ARE EMERGENCY CORE COOLING CAPABILITY, FUEL FAILURE PHENOMENA UNDER ABNORMAL CONDITIONS, AND DEVELOPMENT OF NEEDED STANDARDS AND QUALITY ASSURANCE PROCEDURES. CURRENT AND PLANNED FUTURE

PROGRAMS SHOULD PROVIDE ADEQUATE CAPABILITY FOR SOLUTION OF PROBLEMS THAT CAN BE IDENTIFIED AT PRESENT, BUT SAFETY IS A MOVING TARGET AND, AS REACTOR DESIGN ADVANCES, A CONTINUING PROGRAM IS FORESEEN.

12-5-1-438 HTGR SAFETY
KAPLAN, S. I.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
FOR A HIGH TEMPERATURE GAS COOLED REACTOR (HTGR), THE POSTULATED ACCIDENT MECHANISMS THAT CARRY POPULATION SAFETY SIGNIFICANCE ARE THOSE WHICH EITHER INCREASE THE RELEASABLE FISSION PRODUCT INVENTORY OF THE PRIMARY SYSTEM OR THOSE WHICH RELEASE THE PRIMARY SYSTEM CONTENTS TO THE ENVIRONMENT. NOMINALLY THESE MECHANISMS COMPRISE LOSS OF COOLANT, GRAPHITE OXIDATION, LOSS OF FORCED CIRCULATION OF COOLANT, REACTIVITY EXCURSIONS, AND CORE BLOCKAGE. HOWEVER, THE SPECIFIC MULTIPLE LINES FOR SAFEGUARDING AGAINST ALL THESE ACCIDENT MECHANISMS WHICH ARE POSTULATED FOR A LARGE HTGR RENDER THE PROBABILITY OF THEIR OCCURRENCE EXTREMELY LOW. SAFETY DIRECTED RESEARCH HAS PROVIDED A GOOD GENERAL UNDERSTANDING OF THE MAJOR FISSION PRODUCT ESCAPE AND TRANSPORT MECHANISMS, CORE PHYSICS, AND GRAPHITE OXIDATION PHENOMENA. ALTHOUGH MUCH DETAILED EXPERIMENTAL INFORMATION IS STILL NEEDED BEFORE RIGOROUS PREDICTIONS OF COOLANT CHEMISTRY AND FISSION PRODUCT BEHAVIOR FOR NEW DESIGNS BECOME FEASIBLE. FUTURE RESEARCH PATHS WILL BE INFLUENCED BY THE SHIFTS IN RELATIVE IMPORTANCE OF CERTAIN ACCIDENT MECHANISMS AS REACTOR SIZE INCREASES, BY INCREASED PUBLIC PRESSURE TO MINIMIZE ALL RADIOACTIVE RELEASES, AND BY NEW DEVELOPMENTS IN FUEL AND COMPONENT DESIGN.

12-5-2-448 PUBLIC OPPOSITION TO NUCLEAR POWER - AN INDUSTRY OVERVIEW
SLATER, M. G.
NIAGARA MOHAWK POWER CORPORATION, SYRACUSE, NEW YORK
THE RECENT HISTORY OF PUBLIC AND PRESS ATTITUDES TOWARD NUCLEAR POWER AND ITS EFFECT ON THE ENVIRONMENT CAN BE TRACED IN THE RESULTS OF POLLS, PANEL MEETINGS, DEBATES, ETC. ALTHOUGH OPPOSITION IS NOT THE RULE, THE QUICK RESPONSE BY THE NUCLEAR INDUSTRY TO THE ENVIRONMENTALISTS' POSITIONS HAS HELPED TO IMPROVE PUBLIC RELATIONS. SINCE NUCLEAR TECHNOLOGY IS INVOLVED IN THESE COMPLEX PROBLEMS, ITS LEADERS MUST DO ALL THEY CAN TO INFORM THE PUBLIC AND TO RESPOND WITH CANDOR TO IMPORTANT QUESTIONS SO THAT MUTUAL TRUST AND UNDERSTANDING MAY PREVAIL. SUCH OPENNESS MAY AT FIRST SEEM SELF-DEFEATING, BUT IN THE LONG RUN IT WILL SUCCEED.

12-5-2-456 THE OUTCRY OVER EXPOSURE GUIDELINES
AUXIER, J. A.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THERE HAS BEEN A GROWING PUBLIC CONCERN ABOUT RADIATION POLLUTION OF THE ENVIRONMENT OVER THE PAST FEW YEARS. ALSO, THE PUBLIC NEWS MEDIA HAVE GIVEN INCREASED COVERAGE TO INDIVIDUALS CRITICAL OF THE RADIATION EXPOSURE GUIDES AND STANDARDS RECOMMENDED BY THE FEDERAL RADIATION COUNCIL AND OTHER NATIONAL AND INTERNATIONAL COMMITTEES AND COUNCILS. THE RECOMMENDATIONS OF THE FEDERAL RADIATION COUNCIL ARE THOSE WITH WHICH THE ATOMIC ENERGY COMMISSION AND OTHER FEDERAL AGENCIES MUST COMPLY. THIS ARTICLE IS INTENDED TO GIVE AN OBJECTIVE VIEW OF SOME OF THE MANY PROBLEMS, HYPOTHESES, AND ASSUMPTIONS THAT UNDERLIE THE POSITIONS OF THOSE CRITICAL OF THE RADIATION EXPOSURE STANDARDS AND GUIDELINES, AS WELL AS THOSE WHO MAINTAIN STAUNCHLY THAT THE RECOMMENDED DOSE LEVELS ARE ADEQUATELY LOW. IT IS CONCLUDED HERE, AS HAS BEEN DONE BY THE NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS, THAT THERE IS NO NEED TO ADJUST THE GUIDELINES AT PRESENT. CURRENT CONTAMINATION LEVELS ARE SO LOW, RELATIVE TO THE GUIDELINES, THAT EXPOSURE LEVELS WILL NOT REACH 10 PERCENT OF THE RECOMMENDED GUIDELINE LIMITS DURING THE NEXT FEW DECADES. CONSEQUENTLY, EVEN IF FUTURE RESEARCH INDICATED A NEED FOR THE FULL 10-FOLD REDUCTION RECOMMENDED BY THE CRITICS, THE AVERAGE POPULATION DOSE WOULD STILL BE BELOW REDUCED GUIDELINES.

12-5-3-461 COMPUTER CODES FOR ANALYZING NUCLEAR ACCIDENTS
WINTON, M. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
MANY COMPUTER PROGRAMS HAVE BEEN DEVELOPED FOR USE IN VARIOUS ASPECTS OF NUCLEAR ACCIDENT ANALYSIS. THE NUCLEAR SAFETY INFORMATION CENTER HAS SEPARATED OVER 200 OF THESE CODES INTO 15 GROUPS AND TABULATED THEM. THE RESULTING TABLE GIVES NAME OF CODE, MACHINE ON WHICH IT IS OPERABLE, ITS LANGUAGE, CORPORATE AUTHOR, A STATEMENT OF WHAT THE CODE DOES, A REFERENCE CITATION, AND DATE OF THE REFERENCE. AN OUTLINE OF THE ANALYSIS OF A LOSS OF COOLANT ACCIDENT IS GIVEN, AND CODES THAT MIGHT BE USED IN THE ANALYSIS ARE BRIEFLY DISCUSSED. SEVERAL COMPARISONS OF SIMILAR CODES ARE CITED, AND SOME OF THE RESULTS ARE DISCUSSED. IN ADDITION, THERE IS NOTATION OF THOSE CODES ON WHICH INFORMATION MAY BE OBTAINED FROM THE ARGONNE CODE CENTER, THE EUROPEAN NUCLEAR ENERGY AGENCY (ENEA) LIBRARY AT ISPRA, AND THE RADIATION SHIELDING INFORMATION CENTER.

12-5-3-497 FUEL ROD FAILURE AND ITS EFFECTS IN LIGHT WATER REACTOR ACCIDENTS
RITTENHOUSE, P. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE STATUS OF RESEARCH AND TESTING FOR IDENTIFYING THE MODES OF FUEL ROD FAILURE THAT MAY RESULT FROM A LOSS OF COOLANT ACCIDENT IN A LIGHT WATER COOLED REACTOR AND THE INFLUENCE OF SUCH FAILURES ON THE EFFICIENCY AND EFFECTIVENESS OF EMERGENCY COOLING ARE REVIEWED. SUBJECTS COVERED INCLUDE DEFORMATION AND RUPTURE OF ZIRCALOY CLADDING OF FUEL RODS, COOLANT CHANNEL BLOCKAGE RESULTING FROM THIS MODE OF FUEL ROD FAILURE, AND EMBRITTLEMENT OF CLADDING BY REACTION WITH STEAM. THE EFFECTS OF ALL THESE FACTORS ON THE INTEGRITY OF THE REACTOR CORE AND ON THE ABILITY TO COOL THE CORE ARE DISCUSSED.

12-5-4-498 RELIABILITY ENGINEERING METHODS IN REACTOR SAFETY TECHNOLOGY
RUBEL, P.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
RELIABILITY ENGINEERING SEEKS DELIBERATELY TO INCREASE THE LIKELIHOOD THAT DEVICES OR SYSTEMS WILL FUNCTION AS INTENDED. TO THIS END, ANALYTICAL TECHNIQUES ARE ROUTINELY APPLIED IN FIELDS SUCH AS AEROSPACE IN WAYS THAT GIVE RATIONAL DIRECTION TO THE VARIOUS QUALITY ASSURANCE ACTIVITIES. A RECENT SURVEY OF SIMILAR APPLICATIONS TO ENHANCE REACTOR SAFETY REVEALED THAT, ALTHOUGH QUALITATIVE ANALYSIS METHODS HAVE BEEN ADOPTED WIDELY, PROBABILISTIC MODELING AND RISK FORECASTING HAVE BEEN SOMEWHAT RESTRICTED BY LACK OF ADEQUATE SUPPORTING INFORMATION. PROBABILISTIC ANALYSIS USE IS EXPANDING, HOWEVER, AS CURRENT EFFORTS GRADUALLY OVERCOME THE INFORMATION PROBLEM. MEANWHILE, QUALITY ASSURANCE HAS BENEFITED FROM THE INSIGHT PROVIDED BY THE PRELIMINARY RISK EVALUATION STUDIES.

12-5-4-499 REACTOR AVAILABILITY AND STATION RELIABILITY FOR CONTINUITY OF SERVICE
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE AVERAGE AVAILABILITY OF FIRST-GENERATION NUCLEAR POWER REACTORS TO PRODUCE UNINTERRUPTIBLY A SUPPLY OF THERMAL ENERGY WAS DETERMINED TO BE 83.4 PERCENT FOR SEVEN COMMERCIALLY OPERATED ELECTRICITY-GENERATING STATIONS BY REVIEWING THE STATION OPERATING REPORTS FOR A 3-YEAR PERIOD. THE SAFEST NUCLEAR POWER REACTOR IS ONE THAT IS IN NORMAL STEADY-STATE OPERATION, AND THEREFORE IT WAS PERTINENT TO DETERMINE THE CAUSES OF ABNORMAL OPERATION OR UNSCHEDULED SHUTDOWN. OPERATIONAL DEVIATIONS AND UNPLANNED STATION SHUTDOWNS WERE ANALYZED AND CATEGORIZED INTO THOSE RELATED TO HEAT TRANSFER SYSTEMS, INSTRUMENTATION AND CONTROLS, AND THE ELECTRIC TURBINE GENERATOR POWER SYSTEM. THE CENTRAL PROBLEM AREAS WERE FOUND TO BE LEAKS IN THE HEAT TRANSFER SYSTEM, DIFFICULTIES WITH THE CONTROL ROD DRIVES IN THE PRIMARY SYSTEM, AND BOTH LEAKS AND TURBINE CONTROLS IN THE SECONDARY PLANT. FROM THE DATA AVAILABLE A FIGURE OF MERIT WAS PRODUCED TO EVALUATE THE UNSCHEDULED SHUTDOWNS AND ALSO TO GIVE A COMPARATIVE EVALUATION OF STATION SERVICE RELIABILITY FOR USE OF UTILITY OPERATORS.

12-5-5-516 REACTOR CONTAINMENT BUILDING SPRAY SYSTEMS FOR FISSION PRODUCT REMOVAL
ROW, T. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
CONTAINMENT BUILDING SPRAY SYSTEMS AS FISSION PRODUCT REMOVAL DEVICES ARE BECOMING WIDESPREAD IN PRESSURIZED WATER REACTOR DESIGN, AND THE AEC HAS BEEN SPONSORING A RESEARCH PROGRAM TO INVESTIGATE THE APPLICABILITY OF THESE SYSTEMS AS ENGINEERED SAFETY FEATURES. THE OAK RIDGE NATIONAL LABORATORY HAS COORDINATED THE PROGRAM FOR THE AEC AND MAINTAINED LIAISON BETWEEN COMMISSION SPONSORED LABORATORIES AND NUCLEAR INDUSTRY. THREE SPRAY SOLUTIONS ARE PRESENTLY IN USE OR BEING SERIOUSLY CONSIDERED BY PLANT DESIGNERS. MOLECULAR IODINE REMOVAL BY THESE SPRAYS IS VERY EFFECTIVE, AND DECONTAMINATION FACTORS RANGING FROM 20 AND 1000 MAY BE OBTAINED, DEPENDING ON THE SOLUTION SELECTED. THE EXPLOSION HAZARD FROM GENERATION OF RADIOLYTIC HYDROGEN, FIRST IDENTIFIED IN THIS PROGRAM IN 1967, CONTINUES TO REQUIRE SERIOUS CONSIDERATION IN PLANT DESIGN.

12-5-5-523 FRACTURE INVESTIGATIONS AND STATUS OF THE HEAVY SECTION STEEL TECHNOLOGY PROGRAM
WITT, F. J. + WHITMAN, G. D.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE HEAVY SECTION STEEL TECHNOLOGY PROGRAM IS ONE OF THE MAJOR NUCLEAR PRESSURE VESSEL SAFETY RESEARCH EFFORTS SPONSORED BY THE U.S. ATOMIC ENERGY COMMISSION. THE SCOPE OF THIS INVESTIGATION COVERS METALLURGY, CHEMISTRY, MATERIAL PROPERTIES, INSPECTION, ANALYTICAL AND EXPERIMENTAL STRESS AND STRAIN ANALYSES, ENVIRONMENTAL EFFECTS, FRACTURE MECHANICS, AND THE GENERAL AREA OF FRACTURE BEHAVIOR. IN THIS ARTICLE, HOWEVER, THE DISCUSSION IS LIMITED MAINLY TO CONSIDERATIONS OF HOW THICKNESS AFFECTS THE FRACTURE BEHAVIOR OF STEELS AS MANIFESTED IN DYNAMIC TEAR TEST SPECIMENS, NIL-DUCTILITY TRANSITION DROPWEIGHT SPECIMENS, COMPACT TENSION SPECIMENS, AND FLAWED TENSILE SPECIMENS. TEST RESULTS HAVE DEMONSTRATED A SIGNIFICANT INCREASE IN TOUGHNESS LEVELS AS A FUNCTION OF TEMPERATURE. SIMILAR BEHAVIOR IS INDICATED TO OCCUR AFTER THE STEEL IS SUBJECTED TO HIGH FAST NEUTRON FLUENCES, ALTHOUGH THERE IS A SIGNIFICANT INCREASE IN THE TEMPERATURE AT WHICH THE MAJOR PORTION OF THE CHANGE OCCURS. IN ADDITION, A PROPOSED

METHOD OF RELATING FLAW SIZE AND NOMINAL STRESS (LOAD) AS A FUNCTION OF TEMPERATURE FOR BRANGIBLE, TRANSITIONAL, AND TOUGH BEHAVIORS HAS BEEN SHOWN TO HAVE A POTENTIAL FOR CALCULATING QUANTITATIVE SAFETY MARGINS IN REACTOR PRESSURE VESSELS.

12-5-6-533 SYMPOSIUM ON HEALTH PHYSICS ASPECTS OF NUCLEAR FACILITY SITING
PELLETIER, C. A.
HEALTH SERVICES LABORATORY, IDAHO FALLS, IDAHO
THE FIFTH ANNUAL MIDYEAR SYMPOSIUM OF THE HEALTH PHYSICS SOCIETY WAS HELD IN IDAHO FALLS, IDAHO, ON NOV. 3-6, 1970. FORTY-TWO PAPERS ON 'HEALTH PHYSICS ASPECTS OF NUCLEAR FACILITY SITING' WERE GIVEN IN SESSIONS DEALING WITH GENERAL SITE-SELECTION CRITERIA FOR NUCLEAR POWER REACTORS, SITING EVALUATIONS FOR LARGE ACCELERATORS, FUEL, COOLANT, AND FISSION PRODUCT INTERACTIONS, EVALUATION OF ENVIRONMENTAL CONTAMINATION AROUND NUCLEAR FACILITIES, BEHAVIOR OF AIRBORNE RADIOACTIVITY, RADIONUCLIDES IN BIOLOGICAL SYSTEMS, COMPARISON OF HAZARDS FROM INTERNAL CONTAMINATION, RADIATION STANDARDS, AND PUBLIC RELATIONS. RAPPORTEUR SESSIONS WERE HELD ON THE ENVIRONMENTAL IMPACT OF OPERATING POWER PLANTS AND FUEL REPROCESSING PLANTS AND ON DIRECT RADIATION FROM CLOUDS.

12-5-7-534 DRESDEN 2 INCIDENT OF JUNE-5,1970
CAGLE, C. D.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
ON JUNE 5, 1970, WHILE DRESDEN UNIT 2 (A SECOND GENERATION BOILING WATER REACTOR) WAS UNDERGOING POWER TESTING AND WAS OPERATING AT APPROXIMATELY 75 PERCENT POWER (1875 MW(T), 623 MW(E)), A SPURIOUS SIGNAL IN THE REACTOR PRESSURE CONTROL SYSTEM ALTERED THE STEAM FLOW TO THE TURBINE AND CAUSED A TURBINE TRIP FOLLOWED BY A REACTOR SCRAM. SUBSEQUENT ERRATIC WATER LEVEL AND PRESSURE CONTROL IN THE REACTOR VESSEL, COMPOUNDED BY A STUCK INDICATOR PEN ON A WATER LEVEL MONITOR - RECORDER AND INABILITY OF THE ISOLATION CONDENSER TO FUNCTION AS NEEDED, LED TO DISCHARGE OF STEAM AND WATER THROUGH SAFETY VALVES INTO THE REACTOR DRY WELL. ELECTRIC CABLES WERE DAMAGED, AND ELECTRIC MOTORS DEVELOPED LOW RESISTANCE PROBLEMS. NO SIGNIFICANT AMOUNT OF RADIOACTIVE CONTAMINATION WAS DISCHARGED TO THE ENVIRONMENT. THERE WAS NO PRESSURE DAMAGE OF THE REACTOR VESSEL OR THE DRY WELL CONTAINMENT WALLS. RECOVERY INCLUDED REPLACING SOME ELECTRIC CABLES WITH IMPROVED CABLES HAVING HIGHER TEMPERATURE RATINGS, REROUTING OTHER ELECTRIC CABLES, DRYING ELECTRIC MOTORS, REORIENTING THE DISCHARGE DIRECTION OF SAFETY VALVES, REVISING THE REACTOR PRESSURE CONTROL SYSTEM, IMPROVING THE CAPABILITY OF THE ISOLATION CONDENSER, AND REVISING OPERATING AND EMERGENCY PROCEDURES. THE REACTOR REMAINED SHUT DOWN UNTIL AUG. 6, 1970. TWO TO 3 WEEKS OF THIS DOWNTIME WAS ASCRIBED TO REFUELING.

12-6-1-549 QUALITY ASSURANCE STANDARDS AND PRACTICES
LANGSTON, W. E.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
THE U. S. ATOMIC ENERGY COMMISSION HAS BEEN TAKING MANY POSITIVE STRENGTHENING ACTIONS TO ESTABLISH AND ENFORCE A SYSTEMATIC, DISCIPLINED APPROACH TO THE ASSURANCE OF QUALITY IN ADVANCED REACTORS AND TEST FACILITIES TO PROVIDE FOR SAFE, RELIABLE, AND ECONOMIC OPERATION IN A TIMELY AND PREDICTABLE MANNER. THIS ARTICLE DESCRIBES SOME OF THESE STRENGTHENING ACTIONS DIRECTED TOWARD THE DEVELOPMENT AND APPLICATION OF QUALITY ASSURANCE STANDARDS AND PRACTICES FOR ADVANCED REACTOR DEVELOPMENT AND TECHNOLOGY PROGRAMS. THIS ARTICLE ALSO DESCRIBES THE ASSISTANCE RENDERED TO THE ANSI SUBCOMMITTEE N45-3 IN THE PREPARATION OF INDUSTRY STANDARDS.

12-6-1-553 CASKS FOR IRRADIATED FUEL - A LOOK AT THE CASK DESIGNERS GUIDE
LANGHAAR, J. W.
E. I. DU PONT DE NEMOURS AND COMPANY, WILMINGTON, DELAWARE
SHIPPING CONTAINERS FOR RADIOACTIVE MATERIALS IN QUANTITIES AND CONCENTRATIONS ABOVE SOME RATHER LOW LIMITS ARE REQUIRED BY FEDERAL REGULATION TO MEET CERTAIN PERFORMANCE CRITERIA UNDER SPECIFIED ENVIRONMENTAL CONDITIONS, INCLUDING A HYPOTHETICAL ACCIDENT. THE THICKLY SHIELDED CONTAINERS FOR IRRADIATED FUEL AND OTHER STRONG GAMMA EMITTERS REQUIRE RIGOROUS DESIGN AND ANALYSIS TO ASSURE RETENTION OF SHIELDING AND ADEQUATE HEAT REMOVAL. MUCH EFFORT HAS BEEN DEVOTED DURING THE PAST 10 YEARS TO DESIGNING CASKS TO MEET THESE REQUIREMENTS AND TO DEVELOPING PROCEDURES TO DEMONSTRATE COMPLIANCE WITH THE REGULATIONS. THE EMPHASIS HAS BEEN PRIMARILY ON LEAD SHIELDED CASKS, WHICH HAVE BEEN COMMONLY USED IN THE UNITED STATES BECAUSE OF A FAVORABLE BALANCE BETWEEN INVESTMENT AND OPERATING COST, UNDER SOME CONDITIONS, THE GREATER PAYLOAD OR SMALLER SIZE OF A URANIUM SHIELDED CASK JUSTIFIES THE GREATER INVESTMENT. AMONG THE DESIGN CONSIDERATIONS ARE HEAT REMOVAL, CRITICALITY, SHIELDING, STRUCTURAL INTEGRITY UNDER IMPACT AND FIRE CONDITIONS, THERMAL BEHAVIOR IN A FIRE, RESISTANCE TO FRACTURE AT VERY LOW TEMPERATURES, AND ASSURANCE OF PROPER FABRICATION. THESE DESIGN CONSIDERATIONS ARE DISCUSSED IN DETAIL IN THE CASK DESIGNERS GUIDE, USAEC REPORT ORNL-NSIC-68, WHICH ALSO DESCRIBES THE METHODS OF ANALYSIS, FABRICATION TECHNIQUES, AND TESTING PROCEDURES FOUND ACCEPTABLE.

12-6-2-562 FISSION GAS EFFECTS IN REACTOR FUELS II. ENGINEERING APPLICATIONS
CARRELL, R. M.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE LITERATURE DEALING WITH THE ENGINEERING EFFECTS OF FISSION GAS BEHAVIOR IN REACTOR FUEL MATERIAL IS QUITE EXTENSIVE. THIS REVIEW COVERS THE PAPERS PUBLISHED FROM 1968 TO 1970. THE 73 PUBLICATIONS CITED AND BRIEFLY SUMMARIZED DEAL PRIMARILY WITH FUEL SWELLING MODELS, HIGH TEMPERATURE EFFECTS, NEW EXPERIMENTAL TECHNIQUES, AND ENGINEERING FOR FISSION GAS RELEASE.

12-6-2-569 A SURVEY OF HEAT CONDUCTION COMPUTER PROGRAMS
SHUKER, M. A.
BETTIS ATOMIC POWER LABORATORY, WEST MIFFLIN, PENNSYLVANIA
MANY PROBLEMS IN REACTOR ANALYSIS REQUIRE KNOWLEDGE OF THE TEMPERATURE VARIATIONS DURING NORMAL REACTOR TRANSIENTS AND IN ACCIDENT SITUATIONS. IN SOLID BODIES THE HEAT CONDUCTION EQUATION DESCRIBES THERMAL BEHAVIOR. MOST OFTEN A CLOSED-FORM SOLUTION CANNOT BE OBTAINED BECAUSE OF COMPLEX GEOMETRIES AND BOUNDARY CONDITIONS. BUT THESE PROBLEMS MAY BE CONVENIENTLY APPROXIMATED BY NUMERICAL SOLUTIONS OBTAINED ON HIGH-SPEED COMPUTERS. ELEVEN HEAT CONDUCTION PROGRAMS REPORTED IN THE LITERATURE ARE REVIEWED. ALL THESE PROGRAMS APPROXIMATE THE HEAT CONDUCTION EQUATION IN AT LEAST TWO DIMENTIONS UNDER TRANSIENT AND STEADY-STATE CONDITIONS FOR GENERAL TYPES OF BOUNDARY CONDITIONS. THE COMPARISON OF PROGRAMS INCLUDES CONSIDERATION OF THE METHOD USED TO DESCRIBE GEOMETRY, THE NUMERICAL DIFFERENCING METHOD, THE MAXIMUM ALLOWABLE NUMBER OF NODES, AND THE MANNER OF SPECIFICATION OF BOUNDARY CONDITIONS, MATERIAL PROPERTIES, AND HEAT-GENERATION RATE.

12-6-3-583 SUBCRITICALITY MEASUREMENT IN AN LMFBR
ACKERMANN, N. J., JR.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
RELIABLE KNOWLEDGE OF THE SUBCRITICALITY STATE OF A NUCLEAR REACTOR AT ALL TIMES DURING SHUTDOWN, COUPLED WITH PROPER ADMINISTRATIVE CONTROL, SHOULD PRECLUDE THE POSSIBILITY OF THAT REACTOR ACCIDENTALLY BECOMING CRITICAL OR SUPERCRITICAL. THIS REVIEW OF THE STATE OF THE ART OF SUBCRITICALITY MEASUREMENT IN THE LMFBR GIVES PARTICULAR ATTENTION TO FOUR MEASUREMENT TECHNIQUES - NEUTRON SOURCE MULTIPLICATION, NEUTRON NOISE ANALYSIS, INVERSE KINETICS, AND PULSED NEUTRONS. IT IS CONCLUDED THAT THE NEUTRON SOURCE MULTIPLICATION TECHNIQUE IS THE ONLY METHOD APPLICABLE FOR MEASURING THE SUBCRITICALITY IN AN LMFBR OVER THE FULL RANGE OF SHUTDOWN. PRESENT SUBCRITICALITY MEASUREMENT DEVELOPMENT PROGRAMS ARE REVIEWED, AND FUTURE APPLICATIONS ARE DISCUSSED.

12-6-4-591 KRYPTON - XENON REMOVAL SYSTEMS
KEILHOLTZ, G. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE NEED FOR MORE ELECTRIC POWER AND THE CORRESPONDING INCREASE IN THE NUMBER OF NUCLEAR POWER REACTORS AND FUEL RECOVERY PLANTS MAKE IT DESIRABLE TO HAVE NEAR ZERO RELEASE OF FISSION PRODUCT GASES TO THE ATMOSPHERE. SYSTEMS FOR RETAINING AND STORING RADIOACTIVE XENON AND KRYPTON HAVE BEEN DEVELOPED, AND FOUR OF THE MOST PROMISING METHODS CAPABLE OF FULL SCALE APPLICATION ARE DESCRIBED. CURRENT SYSTEMS INVOLVE ONE OR MORE OF THE FOLLOWING PROCESSES (1) ADSORPTION ON CHARCOAL AT AMBIENT OR LOWER TEMPERATURES, (2) CRYOGENIC DISTILLATION WITHOUT CHARCOAL, (3) SEPARATION BY PERMSELECTIVE MEMBRANES, AND (4) SELECTIVE ABSORPTION OF KRYPTON AND XENON IN FLUOROCARBON SOLVENTS.

12-6-5-600 EFFECTS ON ORGANISMS OF ENTRAINMENT IN COOLING WATER - STEPS TOWARD PREDICTABILITY
COUTANT, C. C.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
MODELS ARE BEING DEVELOPED AT OAK RIDGE NATIONAL LABORATORY AND ELSEWHERE FOR PREDICTING ECOLOGICAL EFFECTS OF THERMAL SHOCKS RECEIVED BY ORGANISMS PASSING THROUGH THERMAL POWER PLANT COOLING SYSTEMS. THE MODELS WERE DEVELOPED INITIALLY FOR STUDYING DIRECTLY LETHAL EFFECTS, BUT THEY ARE APPLICABLE TO SUCH SUBLETHAL EFFECTS AS EQUILIBRIUM LOSS AND INCREASED SUSCEPTIBILITY TO PREDATION. THESE PREDICTIVE MODELS AND THE BASIC BIOLOGICAL DATA REQUIRED FOR USE OF THEM PROVIDE FOR SELECTION OF LIMITS OF TEMPERATURE ELEVATIONS AND DURATIONS OF EXPOSURE TO WARMED WATER AT POWER PLANTS WHICH WILL PREVENT DETRIMENTAL EFFECTS.

12-6-6-608 FAILURE OF N REACTOR PRIMARY SCRAM SYSTEM
GALLAGHER, G. R.
U.S. ATOMIC ENERGY COMMISSION, RICHLAND, WASHINGTON
THE N REACTOR AT HANFORD SCRAMMED FROM AN OPERATING LEVEL OF APPROXIMATELY 450 MW AT 0525 HR, SEPT. 30, 1970. THE REACTOR WAS IN A POWER HOLDING MODE WITH THE PRIMARY LOOP AT EQUILIBRIUM FLOW AND TEMPERATURE. THE SCRAM SIGNAL WAS INITIATED BY SIMULTANEOUS LOW FLOW TRIPS ON SEVERAL PROCESS TUBES. OWING TO A UNIQUE MALFUNCTION, THE ROD SAFETY SYSTEM DID NOT RESPOND TO THE SCRAM SIGNAL. OTHER SCRAM TRIP

INSTRUMENTATION RESPONDED AS DESIGNED, AND THE REACTOR WAS SHUT DOWN AND MAINTAINED IN A SAFE CONDITION BY THE BALL SAFETY SYSTEM. NO OVERHEATING OF REACTOR COMPONENTS OCCURRED, AND NO RADIATION WAS RELEASED. THE SHUTDOWN TRANSIENT WAS NORMAL IN ALL RESPECTS. THE LOW FLOW WAS CAUSED BY A PRIMARY PUMP TRIPPING FROM STEAM TURBINE DRIVE SPEED DOWN TO PONY MOTOR ELECTRIC DRIVE SPEED. THE TURBINE TRIP WAS PRECIPITATED BY ONE OF THE TURBINE CONDENSER CONDENSATE PUMPS LOSING SUCTION BECAUSE OF A PLUGGED SCREEN. THE SAFETY RODS FAILED TO SCRAM OWING TO A COMBINATION OF CIRCUMSTANCES INVOLVING THE NO. 59 ROD ASSIGNMENT SWITCH BEING IN THE OFF POSITION AND THERE BEING FOUR FAILED (SHORTED) DIODES IN THE NO. 59 ROD SCRAM CIRCUIT. THIS COMBINATION OF EVENTS AND THE PARALLED WIRING CHARACTERISTICS OF THE ROD SAFETY CIRCUIT ALLOWED POWER FROM AN AUXILIARY ELECTRICAL CIRCUIT TO FEED ALL THE ROD SCRAM SOLENOIDS AND THUS KEEP THEM ENERGIZED AFTER THE MAIN SCRAM RELAYS HAD TRIPPED.

13-6-6-015 SYMPOSIUM ON THE TRAINING OF NUCLEAR FACILITY PERSONNEL
MCCORD, R. V.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
TWENTY-TWO PAPERS AND A PANEL DISCUSSION WERE PRESENTED AT THE SYMPOSIUM ON THE TRAINING OF NUCLEAR FACILITY PERSONNEL. THE PAPERS COVERED ALL FACETS OF NUCLEAR REACTOR OPERATOR TRAINING FROM PHILOSOPHY AND OBJECTIVES TO DETAILED TRAINING METHODS. TWO PAPERS WERE PRESENTED ON THE TRAINING AND LICENSING OF RADIOCHEMICAL PROCESSING PLANT PERSONNEL. SEVERAL PAPERS DISCUSSED PUBLIC RELATIONS AND THE EDUCATION OF THE PUBLIC FOR THE ACCEPTANCE OF NUCLEAR POWER.

13-1-1-001 THE ROLE OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS IN THE REACTOR LICENSING PROCESS
BUSH, S. H.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
THE ROLE OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS) IN THE REACTOR LICENSING PROCESS IS REVIEWED IN THE CONTEXT OF ITS ORIGINAL CHARTER ESTABLISHED BY CONGRESS. SPECIFICALLY, MEMBERSHIP AND OPERATIONAL PROCEDURES ARE REVIEWED WITH RESPECT TO SPECIFIC PROJECTS. AN IMPORTANT ACTIVITY OF THE ACRS IS REVIEW OF GENERIC SAFETY ITEMS AND CODES, STANDARDS, AND CRITERIA. RECOMMENDATIONS AND COMMENTS ARE MADE CONCERNING AREAS WHERE CONTINUING IMPROVEMENTS ARE POSSIBLE IN THE REGULATORY WORK LOAD, EVALUATION OF DESIGN CONCEPTS, AND OPERATION OF THE ACRS.

13-1-1-013 SOME EFFECTS OF PUBLIC INTERVENTION ON THE REACTOR LICENSING PROCESS
BRIGHT, G. O.
AEROJET NUCLEAR COMPANY, IDAHO FALLS, IDAHO
THE ENVIRONMENTAL PROTECTION MOVEMENT, WHICH HAS GROWN SO STRONG OVER THE LAST 2 TO 3 YEARS, HAS GREATLY AFFECTED THE CIVILIAN POWER REACTOR LICENSING PROCESS. INTERVENTION IN PUBLIC LICENSING HEARINGS AND COURT ACTION HAVE BOTH BEEN WIDELY EMPLOYED, WITH A NET RESULT, IN MANY CASES, OF SIGNIFICANTLY INCREASING THE TIME REQUIRED TO OBTAIN BOTH CONSTRUCTION AND OPERATING LICENSES. IT IS CONCLUDED THAT A STRONG EFFORT MUST BE MADE BY INDUSTRY IF PROTRACTED DELAYS ARE TO BE AVOIDED.

13-1-2-022 THE DEVELOPMENT OF REACTOR SITING CRITERIA BASED UPON RISK PROBABILITY
MELEIS, M. + ERDMANN, R. C.
UNIVERSITY OF CALIFORNIA AT LOS ANGELES, LOS ANGELES, CALIFORNIA
EXAMINATION OF THE ORIGINALLY PROPOSED FARMER LIMIT LINE CRITERION FOR NUCLEAR PLANTS LED TO A TOTAL INDIVIDUAL MORTALITY RISK THAT IS FAIRLY HIGH WITH RESPECT TO OTHER RECORDED RISKS. FOR EXAMPLE, IN THE CASE OF AN EQUAL WIND DIRECTION PROBABILITY OF 1/12 (ANY 30 DEGREE VECTOR OVER A 360 DEGREE CIRCLE), THE TOTAL RISK FROM AN ACCIDENTAL RELEASE AT THE PLANT WAS ONLY 3.4 X 10(EXP-6) BUT WAS STILL 34 TIMES THAT CAUSED BY LIGHTNING. A NEW LOCATION FOR THE LIMIT LINE WAS THEREFORE DEDUCED THAT WOULD SATISFY BOTH FARMER'S PROBABILISTIC SAFETY ANALYSIS PHILOSOPHY AND AT THE SAME TIME LIMIT THE ADDED RISK TO THE INDIVIDUALS LIVING AT THE EXCLUSION RADIUS TO A VERY LOW VALUE. FINALLY, THE PROBABILISTIC SAFETY ANALYSES OF THREE EXISTING NUCLEAR PLANTS ARE COMPARED WITH THE ORIGINAL AND MODIFIED LIMIT LINES. HENCE ONE CAN OBSERVE A CORRESPONDENCE BETWEEN CALCULATED PLANT RELEASE DATA AND THE LIMIT LINE CONCEPT. WE THUS CONCLUDE THAT AN INTEGRATED SAFETY ANALYSIS BASED ON THE LIMIT LINE CONCEPT COULD PROVIDE THE NUCLEAR INDUSTRY WITH AN ADEQUATE REACTOR SITING TECHNIQUE.

13-1-3-029 THE FOURTEENTH POWER INSTRUMENTATION SYMPOSIUM OF THE INSTRUMENT SOCIETY OF AMERICA
HAGEN, E. W. + RHODE, G. K. + BASSETT, T. O.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE - NIAGARA MOHAWK POWER CORPORATION, SYRACUSE, NEW YORK
THE ELECTRIC POWER GENERATION SEGMENT OF THE NUCLEAR FIELD IS INCREASING IN SIZE AND IN IMPORTANCE AND, THEREFORE, IN ITS RESPONSIBILITIES AND NEED TO BE HEARD. SOME OF THIS INDUSTRY'S CONCERNS ABOUT STANDARDS, RELIABILITY, COMMUNICATIONS, AND INSTRUMENTATION AND CONTROL NEEDS WERE EXPRESSED AT THE INSTRUMENT SOCIETY OF AMERICA'S 14TH POWER INSTRUMENTATION SYMPOSIUM. MORE STANDARDS ARE STILL NEEDED, AND TO RESOLVE SOME OF THE MAJOR SAFETY PROBLEMS NOW BEFORE THE INDUSTRY, SEVERAL

IMPORTANT INSTRUMENTATION AND CONTROL OBJECTIVES MUST BE MET. ALSO COMMUNICATION BETWEEN THE ENGINEERING DESIGN AND THE OPERATING GROUPS COULD BE IMPROVED.

13-1-4-037 CONTAMINATION CONTROL OF SODIUM RELEASES FROM LIQUID METAL COOLED FAST BREEDER REACTORS
FIRST, M. W.
HARVARD SCHOOL OF PUBLIC HEALTH, BOSTON, MASSACHUSETTS
ALTHOUGH LIQUID METAL COOLED FAST BREEDER REACTORS ARE DESIGNED TO AVOID SODIUM RELEASES, SOUND PUBLIC HEALTH PRACTICE DEMANDS THAT THE NATURE AND POTENTIAL CONSEQUENCES OF EVERY CONCEIVABLE TYPE OF RELEASE BE EVALUATED. IN THIS ARTICLE A TYPICAL REACTOR HANDLING LARGE VOLUMES OF HOT SODIUM IS ANALYZED CAREFULLY TO DETERMINE WHERE ACCIDENTAL LEAKS AND SPILLS MAY OCCUR. STANDBY CONTROL METHODS ARE RECOMMENDED TO PREVENT SPREAD OF AIRBORNE SODIUM AND ITS REACTION PRODUCTS, TO REDUCE REACTOR SHUTDOWN TIME, AND TO MINIMIZE CLEANUP COSTS. CRITICAL FACTORS AFFECTING THE DESIGN OF ENGINEERED CONTROLS FOR THE CONTAINMENT OF ACCIDENTAL SODIUM RELEASES WERE TEMPERATURE OF THE METAL, OXYGEN CONCENTRATION AND SIZE OF THE SPACE INTO WHICH THE SPILL OR LEAK OCCURS, RATE OF SODIUM ESCAPE, AND THE AMOUNT OF SODIUM LIKELY TO BE RELEASED BEFORE REMEDIAL MEASURES CAN BE TAKEN TO STOP IT.

13-1-5-047 FAILURES OF THREADED FITTINGS AND FASTENERS AT NUCLEAR FACILITIES
SCOTT, R. L. + HARLEY, P. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THIRTY-THREE INCIDENTS ARE TABULATED CONCERNING PROBLEMS ENCOUNTERED WITH BOLTS, SCREWS, NUTS, AND THREADED FITTINGS, ALL OF WHICH SHOULD BE OF INTEREST TO BOTH DESIGNERS AND OPERATORS. THESE INCIDENTS HAVE REQUIRED APPROXIMATELY 70 MONTHS OF ADDITIONAL REACTOR DOWNTIME. AT ONE FACILITY AN ESTIMATED EXPENDITURE OF $10,000 WAS CAUSED BY THE FAILURE OF A 1-IN. THREADED STRAINER PLUG. THE THREE MAJOR TYPES OF FAILURES - CORROSION, FATIGUE, AND GALLING - ARE DISCUSSED.

13-1-5-054 ON ESTIMATING FISSION-PRODUCT RADIATION AND THERMAL POWER SOURCE STRENGTH
CLACK, R. W. + ECKHOFF, N. D.
KANSAS STATE UNIVERSITY, MANHATTAN, KANSAS
ASSUMING EXTENDED STEADY-STATE REACTOR OPERATION, USEFUL APPROXIMATIONS OF FISSION PRODUCT SOURCE STRENGTH (IN CURIES) CAN BE MADE BY MULTIPLYING THE THERMAL-ENERGY RELEASE (IN MWD) BY 100 AND DIVIDING BY THE TIME INTERVAL FROM SHUTDOWN (IN YEARS).

13-2-1-099 THE ASME CODE QUALITY-ASSURANCE PROGRAM FOR NUCLEAR REACTORS
MCGUFFEY, J. F.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
TO ENHANCE THE SAFETY AND RELIABILITY OF VESSELS, PUMPS, VALVES, AND PIPING USED IN NUCLEAR POWER SYSTEMS, THE ASME BOILER AND PRESSURE VESSEL CODE HAS SET FORTH SPECIFIC QUALITY-ASSURANCE (QA) RESPONSIBILITIES FOR THE OWNER, THE MANUFACTURERS, THE INSTALLERS, THE ASME, AND AUTHORIZED INSPECTION AGENCIES. IN PARTICULAR, THE MANUFACTURERS AND THE INSTALLERS OF SUCH COMPONENTS MUST OPERATE UNDER A CONTROLLED MANUFACTURING SYSTEM AND UNDER DETAILED QA PROGRAMS. THIS APPROACH TO CONTROLLING THE DESIGN, FABRICATION, AND INSTALLATION OF NUCLEAR COMPONENTS DURING THE PAST 3 YEARS HAS MATERIALLY IMPROVED THE INTEGRITY OF NUCLEAR PRESSURE BOUNDARY AND PRESSURE-CONTAINING SYSTEMS.

13-2-1-103 THE IMPACT OF THE PROPOSED REVISIONS TO IAEA REGULATIONS FOR THE SAFE TRANSPORT OF RADIOACTIVE MATERIALS
SEAGREN, R. D.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
AN EFFORT IS UNDER WAY TO REVISE AND UPDATE THE IAEA REGULATIONS FOR THE SAFE TRANSPORT OF RADIOACTIVE MATERIALS. UNDER THE NEW REGULATIONS THE PRESENT SYSTEM OF CLASSIFYING RADIOACTIVE MATERIAL INTO GROUPS ACCORDING TO THE RADIOTOXICITY OF THE RADIONUCLIDE CONCERNED WILL BE DISCONTINUED. INSTEAD, ASSESSMENTS OF THE LIKELY INTAKE OF RADIOACTIVE MATERIAL AFTER SERIOUS DAMAGE TO PACKAGING ARE COMBINED WITH CALCULATED RADIATION DOSES FOR UNIT INTAKE OF SOME 280 RADIONUCLIDES TO DERIVE A THEORETICAL SAFE LIMIT FOR THE RADIOACTIVE CONTENT OF TRANSPORT PACKAGES. ACTIVITY RELEASE RATES FOR PACKAGING UNDER NORMAL CONDITIONS OF TRANSPORT AS WELL AS UNDER ACCIDENT CONDITIONS ARE TO BE BASED ON THESE SAFE LIMITS.

13-2-2-107 STRUCTURAL EFFECTS OF CONFINED DYNAMIC LOADS
HABIP, L. M.
FORD RESEARCH AND ENGINEERING CENTER, DEARBORN, MICHIGAN
THIS REVIEW OF MODERN METHODS OF DESIGN AND ANALYSIS IN THE FIELD OF STRUCTURAL EFFECTS OF DYNAMIC LOADS STEMS FROM CURRENT NEEDS TO ENSURE THE CONTAINMENT OF CHEMICAL REACTIONS THAT MAY ACCIDENTALLY OCCUR IN LIQUID METAL HEATED STEAM GENERATORS ASSOCIATED WITH CERTAIN NUCLEAR POWER PLANTS. IT IS RECOMMENDED THAT THE DESIGN OF CYLINDRICAL VESSELS SUBJECTED TO TRANSIENT INTERNAL PRESSURES BE BASED ON THE AMPLITUDE - IMPULSE PLANE REPRESENTATION OF THE DYNAMIC BURSTING CRITERION. METHODS AVAILABLE FOR APPLICATION TO THE PROBLEM UNDER CONSIDERATION ARE DYNAMIC LIMIT ANALYSIS AND FINITE DIFFERENCE ANALYSIS, WITH BRIEF MENTION OF RECENT DEVELOPMENTS IN FINITE ELEMENT METHODS.

13-2-2-114 SIMULATING STRONG MOTION EARTHQUAKE EFFECTS ON NUCLEAR POWER PLANTS
SMITH, C. B. + MATTHIESEN, R. B.
UNIVERSITY OF CALIFORNIA, LOS ANGELES, CALIFORNIA
RESEARCH BEING CONDUCTED TO DETERMINE THE EFFECTS OF EARTHQUAKES ON NUCLEAR POWER PLANTS INCLUDES DYNAMIC TESTS OF FULL-SCALE NUCLEAR POWER PLANTS AND THE DEVELOPMENT OF MATHEMATICAL MODELS OF THE SYSTEM BASED ON EXPERIMENTAL RESULTS. THESE TESTS HAVE BEEN CONDUCTED AT THE UCLA RESEARCH REACTOR, THE EXPERIMENTAL GAS-COOLED REACTOR (EGCR), THE CAROLINAS-VIRGINIA TUBE REACTOR (CVTR), THE FERMI FAST BREEDER REACTOR, AND THE SAN ONOFRE NUCLEAR GENERATING STATION. EXPERIMENTAL INVESTIGATIONS INCLUDE THE RESPONSE DUE TO AMBIENT EXCITATION (WIND AND NATURAL GROUND VIBRATIONS), FORCED VIBRATIONS USING STRUCTURAL VIBRATORS, FORCED VIBRATIONS USING IMPULSES, FREE VIBRATIONS FROM A LARGE INITIAL DISPLACEMENT ('SNAPBACK' TESTS), AND FORCED VIBRATIONS CAUSED BY EXPLOSIVE BLASTS. THE MAJOR EMPHASIS OF THE WORK IS ON DEVELOPING METHODS FOR EXCITING FULL-SCALE STRUCTURES AT LEVELS COMPARABLE WITH STRONG MOTION EARTHQUAKES AND USING THESE TESTS TO DEVELOP MATHEMATICAL MODELS FOR REACTOR SYSTEMS. CURRENT EFFORT IS CONCENTRATED ON ANALYZING THE RESULTS OF BLAST TESTS. ANALYSIS TO DATE HAS PROVED THE FEASIBILITY OF THE BLAST TECHNIQUES AND IS GIVING INSIGHT INTO THE NONLINEARITIES ASSOCIATED WITH HIGH LEVEL RESPONSE. EXCELLENT AGREEMENT WAS OBTAINED IN COMPARISONS OF FORCED VIBRATION TEST DATA AND BLAST DATA. NEVERTHELESS, NONLINEAR BEHAVIOR OF NUCLEAR PLANT COMPONENTS IS STILL NOT WELL UNDERSTOOD, AND ADDITIONAL WORK IS REQUIRED TO DEFINE THE MECHANISMS THAT GIVE RISE TO NONLINEARITIES.

13-2-4-122 PIPE RUPTURE STUDY - 1971
VANDENBERG, S. R.
GENERAL ELECTRIC COMPANY, SAN JOSE, CALIFORNIA
THE PIPE RUPTURE STUDY IS CONCERNED WITH EXTENDING THE UNDERSTANDING OF FAILURE CAUSING MECHANISMS AND IMPROVING THE CAPABILITY FOR EVALUATING REACTOR PIPING SYSTEMS TO MINIMIZE THE PROBABILITY OF FAILURES. FOLLOWING A DETAILED REVIEW TO DETERMINE THE EFFORT MOST NEEDED TO IMPROVE NUCLEAR SYSTEM PIPING (PHASE I), ANALYTICAL AND EXPERIMENTAL EFFORTS (PHASE II) WERE STARTED IN 1965. THIS STATUS REPORT SUMMARIZES THE ACCOMPLISHMENTS OF A BROAD PROGRAM IN (1) AT-REACTOR TESTS OF THE EFFECT OF PRIMARY COOLANT ENVIRONMENT ON THE FATIGUE BEHAVIOR OF PIPING STEELS, (2) FATIGUE STUDIES THROUGH BOTH BENCH-SCALE AND LARGE COMPONENT TESTS, (3) FRACTURE MECHANICS, (4) SOLUTION OF PROBLEMS IN STRESS ANALYSIS, AND (5) FAILURE PROBABILITY STUDY OF ACTUAL REACTOR PIPING SYSTEMS. BROADLY, THE RESULTS OBTAINED SHOW THAT PRIMARY PIPING SYSTEMS ARE VERY SAFE, THAT SUCH PIPING IS CONSERVATIVELY DESIGNED (TO B31.7 NUCLEAR PIPING CODE), AND THAT THE MATERIALS, PARTICULARLY IN LOW CYCLE FATIGUE, ARE SUCH THAT CONSIDERABLE LEEWAY EXISTS ON THE SIDE OF SAFETY, I.E., THE NUMBER OF STRESS CYCLES TO INITIATE AND GROW CRACKS THROUGH PIPE WALLS ARE AT LEAST AN ORDER OF MAGNITUDE GREATER THAN THE NUMBER OF CYCLES IN PLANT SERVICE LIFETIMES OF 40 YEARS.

13-2-5-130 ESTIMATES OF DOSE TO NORTHERN HEMISPHERE POPULATION GROUPS FROM KRYPTON-85 EMITTED BY A SINGLE NUCLEAR FUEL REPROCESSING PLANT
KNOX, J. B. + PETERSON, K. R.
LAWRENCE RADIATION LABORATORY, LIVERMORE, CALIFORNIA
THE RADIOACTIVE DOSE TO NORTHERN HEMISPHERE POPULATION GROUPS FROM KRYPTON-85 EMITTED BY A TYPICAL NUCLEAR FUEL REPROCESSING PLANT IS ESTIMATED FOR VARIOUS DISTANCES AND TIMES, INCLUDING THE GLOBAL EQUILIBRIUM POPULATION DOSE RESULTING FROM A CONSTANT RATE OF EMISSION. THE TOTAL POPULATION DOSE AT ANY LOCATION DEPENDS ON BOTH THE PROXIMITY TO THE PLANT AND THE POPULATION OF THE AREA AFFECTED. THE LARGEST POPULATION DOSE OCCURS IN ASIA, PRINCIPALLY BECAUSE OF ITS DENSE POPULATION, BUT THIS IS A SMALL FRACTION OF THAT RECEIVED FROM NATURAL RADIOACTIVITY. THE NEXT LARGEST DOSE IS WITHIN 1000 KM OF THE SOURCE, AND THE SMALLEST DOSES ARE IN POLAR AND EQUATORIAL LATITUDES.

13-3-0-181 NUCLEAR SAFETY AT GENEVA - A REVIEW OF THE NUCLEAR SAFETY ASPECTS OF THE FOURTH GENEVA CONFERENCE
NUCLEAR SAFETY EDITORIAL STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE NUCLEAR SAFETY ASPECTS OF THE FOURTH INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD AT GENEVA IN SEPTEMBER 1971, DEALT WITH ENVIRONMENTAL ASPECTS AND PUBLIC ACCEPTANCE, INSURANCE AND REGULATION, POWER PLANT SAFETY, WASTE MANAGEMENT, HEALTH PHYSICS AND RADIATION PROTECTION, AND NUCLEAR PLANT PERFORMANCE. THE AUTHORS OF THE MORE THAN 100 PAPERS GIVEN AT THESE SESSIONS, REPRESENTING MOST OF THE WORLD'S NATIONS WITH NUCLEAR POWER CAPABILITY, WERE GENERALLY SANGUINE IN THEIR PRESENTATIONS AND SEEMED TO FEEL THAT CONTINUED EXPERIENCE AND ADVANCING TECHNOLOGY WOULD EVENTUALLY SOLVE MOST IF NOT ALL THE PROBLEMS CURRENTLY ASSOCIATED WITH NUCLEAR POWER. RESEARCH AND DEVELOPMENT MUST CONTINUE, HOWEVER, IN ORDER TO MAKE POSSIBLE THE PROMISE OF ABUNDANT POWER TO THE NEXT CENTURY'S TEEMING MILLIONS WHO WOULD OTHERWISE FACE ENERGY STARVATION.

13-3-1-209 BALANCING ENVIRONMENTAL IMPACT AND ECONOMIC PROGRESS - THE IMPACT OF THE COURTS
NICHOLS, B. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
ALTHOUGH ENVIRONMENTAL LEGISLATION RESULTING FROM PUBLIC CONCERN DATES BACK TO THE RIVERS AND HARBORS ACT OF 1899, ONLY RECENTLY HAS THE MOMENTUM OF CONCERN RESULTED IN FEDERAL LEGISLATION THAT FORMALLY WEIGHS THE COSTS OF ENVIRONMENTAL IMPACT AGAINST THE ECONOMIC AND TECHNICAL BENEFITS TO BE GAINED. THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969 (NEPA) NOT ONLY STRENGTHENS PREVIOUS LEGISLATION BUT, IN ADDITION, REQUIRES A BALANCING OF THE ENVIRONMENTAL IMPACT AND THE TECHNICAL AND ECONOMIC BENEFITS TO THE PUBLIC AS A WHOLE. THE INTERPRETATION OF NEPA BY THE U.S. COURT OF APPEALS FOR THE DISTRICT OF COLUMBIA CIRCUIT IN THE CALVERT CLIFFS CASE HAS HAD CONSIDERABLE IMPACT ON BOTH THE U.S. ATOMIC ENERGY COMMISSION (AEC) AND THE ELECTRIC-POWER INDUSTRY. ALTHOUGH THE BURDEN ON THE COMMISSION AND INDUSTRY MAY SEEM CUMBERSOME, IT IS CONCEIVABLE THAT THE THOROUGH REVIEW OF ALL ASPECTS OF PLANNED PROJECTS REQUIRED BY NEPA MAY RESULT IN A TWOFOLD BENEFIT - THE REDUCTION OF BOTH ENVIRONMENTAL IMPACT AND ECONOMIC OUTLAY AT FUTURE NUCLEAR POWER PLANTS. THIS ARTICLE DISCUSSES THE IMPLICATIONS FOR THE NUCLEAR POWER INDUSTRY OF ENVIRONMENTAL LEGISLATION AND THE DECISION OF THE COURT IN THE CALVERT CLIFFS CASE.

13-3-1-216 NATIONAL CONFERENCE ON WASTE HEAT UTILIZATION
MORGAN, J. G.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE CONFERENCE ON WASTE HEAT UTILIZATION WAS HELD IN GATLINBURG, TENN., OCT. 27-29, 1971. AMONG THE TOPICS CONSIDERED WERE TECHNICAL STATUS FOR HEAT UTILIZATION, DEMONSTRATION PROJECTS, MARKETING AND ECONOMICS, PROJECTED APPLICATIONS, SITE SELECTION, AND WATER LAW AND WATER REGULATIONS. ALTHOUGH AT PRESENT THE FRACTION OF WASTE HEAT EFFECTIVELY USED MAY BE SMALL, THE CONFERENCE PROJECTED A SENSE OF URGENCY FOR PROMPT PLANNING AND ACTION. HOWEVER, IT WAS ALSO POINTED OUT THAT REGULATION CONSTRAINTS AND UNCERTAINTIES ACT AS DETERRENTS TO FINANCIAL INVESTMENT FROM PRIVATE SECTORS.

13-3-3-220 DETECTION OF FAILED FUEL ELEMENTS
GROOS, E.
COMMISSION OF THE EUROPEAN COMMUNITIES, KERNFORSCHUNGSANLAGE, JULICH, GERMANY
SAFETY, VERSATILITY, AND ECONOMY OF A HIGH TEMPERATURE PEBBLE-BED REACTOR COULD BE IMPROVED IF FUEL ELEMENTS WITH UNDESIRED HIGH FISSION PRODUCT RELEASE WERE REMOVED FROM THE CORE LOADING. HOWEVER, MEASUREMENTS FOR DETECTING THESE LEAKY ELEMENTS CAN ONLY BE PERFORMED DURING THE INTERCYCLING PERIODS WHEN A FUEL ELEMENT IS OUT OF THE CORE. THE COMMON DIFFICULTY ENCOUNTERED IN THE THREE DETECTION METHODS INVESTIGATED WAS THE SHORT TIME AVAILABLE FOR MEASUREMENTS, 7 TO 24 SEC, DEPENDING ON THE RATE OF CIRCULATION OF THE FUEL ELEMENTS. A FISSION GAS ANNEALING METHOD HAS PROVED APPLICABLE, AND A TECHNIQUE USING A LASER BEAM FOR REMOVING SMALL AMOUNTS OF GRAPHITE FOR BETA COUNTING IS STILL BEING EXAMINED.

13-3-5-225 THE 1971 TRITIUM SYMPOSIUM AT LAS VEGAS
BARTON, C. J. + BUTLER, M. M. + CUMMING, R. B.
ROHWER, P. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
A 'TRITIUM SYMPOSIUM' SPONSORED BY THE WESTERN ENVIRONMENTAL RESEARCH LABORATORY OF THE ENVIRONMENTAL PROTECTION AGENCY AND THE UNIVERSITY OF NEVADA AT LAS VEGAS WAS HELD IN LAS VEGAS AUG. 30 TO SEPT. 2, 1971. APPROXIMATELY 100 PAPERS WERE PRESENTED COVERING A BROAD RANGE OF TOPICS, INCLUDING TRITIUM PRODUCTION, ITS MOVEMENT IN THE ENVIRONMENT, ENVIRONMENTAL RELEASE AND MONITORING, DETECTION AND MEASUREMENT, BIOLOGICAL EFFECTS, BIOKINETICS, APPLICATIONS IN BIOLOGY AND MEDICINE, AND HEALTH PHYSICS. SOME SPEAKERS REVIEWED PUBLISHED INFORMATION, BUT MANY NEW DATA WERE DISCUSSED BY OTHERS. THE SYMPOSIUM SERVED A USEFUL PURPOSE IN GATHERING TOGETHER SCIENTISTS CONCERNED WITH DIVERSE ASPECTS OF THIS IMPORTANT HYDROGEN ISOTOPE. MOST OF THE PAPERS FROM THE SYMPOSIUM, ALONG WITH SOME THAT WERE NOT PRESENTED, WILL BE PUBLISHED IN THE PROCEEDINGS DURING THE SUMMER OF 1972. THIS ARTICLE TOUCHES ON ALL ASPECTS OF THE MEETING, BUT PAPERS OF PARTICULAR INTEREST IN THE FIELD OF NUCLEAR SAFETY ARE EMPHASIZED.

13-4-1-275 NATURAL RADIATION IN THE URBAN ENVIRONMENT
YEATES, D. B. + GOLDIN, A. S. + MUELLER, D. W.
HARVARD UNIVERSITY, BOSTON, MASS.
NATURAL RADIATION IS THE LARGEST SOURCE OF POPULATION DOSE AND IS IMPORTANT AS A BASE LINE WITH WHICH RADIATION PROTECTION STANDARDS MAY BE COMPARED. IN THIS ARTICLE PREVIOUS WORK ON NATURAL BACKGROUND RADIATION LEVELS IS SUMMARIZED, AND SOME NEW DATA FROM BOSTON, MASS., ARE REPORTED. GAMMA DOSE RATES, CORRECTED FOR COSMIC RADIATION, WERE MEASURED WITH LARGE IONIZATION CHAMBERS - DOSE RATES INSIDE WOODEN SINGLE FAMILY

DWELLINGS WERE 25 TO 50 PERCENT LOWER THAN THOSE OUTSIDE. IN MASONRY MULTIPLE FAMILY DWELLINGS, THEY WERE ABOUT 10 PERCENT LOWER. CONCENTRATIONS OF RADON DAUGHTERS IN THE AIR WERE MEASURED BY PREDECAY AND POSTDECAY ALPHA SPECTROMETRY - CONCENTRATIONS IN DWELLINGS WERE COMPARABLE WITH OUTDOOR CONCENTRATIONS, BUT CONCENTRATIONS IN BASEMENTS WERE HIGHER BY A FACTOR OF ABOUT 5. CONCENTRATIONS IN OFFICE BUILDINGS WERE QUITE LOW, THE RADON DAUGHTERS BEING REMOVED BY THE VENTILATION SYSTEM. EFFECTS OF BUILDING TYPE, CONSTRUCTION MATERIALS, AND VENTILATION ON HUMAN DOSE ARE DISCUSSED, AS ARE POSSIBLE WAYS OF REDUCING POPULATION DOSE.

13-4-2-287 SPACE - TIME REACTOR DYNAMICS - A REVIEW OF THE 1970 CREST CONFERENCE ON REACTIVITY EFFECTS IN LARGE POWER REACTORS
SMETS, H. B.
EUROPEAN NUCLEAR ENERGY AGENCY, PARIS, FRANCE
THE FIRST EUROPEAN CONFERENCE ON REACTIVITY EFFECTS IN LARGE POWER REACTORS WAS HELD AT ISPRA, ITALY, ON OCT. 27-30, 1970. FORTY-FIVE REPRESENTATIVES OF 14 COUNTRIES AND INTERNATIONAL ORGANIZATIONS MET TO CONSTITUTE A «ORLOAIDE FORUM ON MATHEMATICAL MODELS AND PRACTICAL CONSEQUENCES OF SPACE-TIME CALCULATIONS. THEY REPORTED THAT SEVERAL COMPUTER PROGRAMS HAD BEEN DEVELOPED FOR THE SOLUTION OF SPACE-TIME PROBLEMS. AS THE MODELS BECOME MORE COMPLEX, HOWEVER, A BALANCE MUST BE STRUCK BETWEEN THE DESCRIPTION OF NEUTRON BEHAVIOR AND THAT OF FEEDBACK EFFECTS SO THAT COMPUTATIONAL IMPROVEMENTS TRULY RESULT IN IMPROVED UNDERSTANDING OF REACTOR BEHAVIOR.

13-4-3-295 A METHOD FOR VERIFYING REACTIVITY - FEEDBACK TIME RESPONSE IN POWER REACTORS
FRY, D. N.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A METHOD IS PRESENTED FOR ON-LINE MONITORING OF THE REACTIVITY FEEDBACK TIME CONSTANTS FOR DETERMINING THE OPERATING STABILITY OF LARGE FAST BREEDER REACTORS. IN THIS METHOD, MONITORING CAN BE PERFORMED WITHOUT INTERFERING WITH NORMAL REACTOR OPERATION, WITH NEGLIGIBLE REACTOR POWER DISTURBANCE, AND WITHOUT THE NEED FOR SPECIAL IN-CORE REACTIVITY OSCILLATORS. THE METHOD ALSO IS CONDUCIVE TO THE DETECTION OF PARTIAL FLOW BLOCKAGES IN COOLANT CHANNELS IN REACTOR CORE SUBASSEMBLIES.

13-4-6-304 ACCIDENTAL COBALT-60 EXPOSURE AT THE UNIVERSITY OF TENNESSEE - ATOMIC ENERGY COMMISSION AGRICULTURAL RESEARCH LABORATORY
WADE, L. JR.
UT-AEC AGRICULTURAL RESEARCH LABORATORY, OAK RIDGE, TENN.
A RESEARCH TECHNICIAN ENTERED A COBALT-60 IRRADIATION FACILITY AT THE UNIVERSITY OF TENNESSEE-ATOMIC ENERGY COMMISSION AGRICULTURAL RESEARCH LABORATORY IN OAK RIDGE, TENN., AND RECEIVED A TOTAL BODY EXPOSURE OF 260 R. CONTRIBUTING FACTORS IN THE INCIDENT WERE MALFUNCTIONING INTERLOCK SYSTEMS, FAILURE TO OBSERVE WARNING DEVICES, AND FAILURE TO FOLLOW ESTABLISHED PROCEDURES. SEVERAL PHYSICAL AND ADMINISTRATIVE CONTROLS HAVE BEEN ADDED TO PREVENT SUCH AN INCIDENT.

13-5-1-353 PRELIMINARY OBSERVATIONS ON THE RADIOLOGICAL IMPLICATIONS OF FUSION POWER
STEINER, D. + FRAAS, A. P.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE RADIOLOGICAL IMPLICATIONS OF FUSION POWER ARE CONSIDERED WITH REFERENCE TO A CONCEPTUAL FUSION REACTOR BASED ON THE DEUTERIUM - TRITIUM FUEL CYCLE. THIS ANALYSIS LEADS TO THE FOLLOWING OBSERVATIONS (1) THE ENGINEERED FEATURES NECESSARY TO LIMIT BIOLOGICAL IMPACT IN THE EVENT OF AN ACCIDENT MAY HAVE TO SATISFY LESS STRINGENT REQUIREMENTS IN FUSION REACTOR DESIGN THAN IN FISSION-REACTOR DESIGN. (2) DURING NORMAL OPERATION, TRITIUM WILL PRESENT THE PRIMARY SOURCE OF RADIOACTIVITY IN EFFLUENTS ASSOCIATED WITH FUSION POWER. THE MONITORING OF TRITIUM IN EFFLUENTS WILL BE REQUIRED ONLY AT THE REACTOR SITE SINCE THE FUEL REPROCESSING SYSTEM OF A FUSION REACTOR IS AN INTEGRAL PART OF THE REACTOR. ECONOMIC CONTAINMENT OF TRITIUM MUST BE A MAJOR OBJECTIVE OF FUSION REACTOR TECHNOLOGY. (3) LONG LIVED RADIOISOTOPES WILL BE PRODUCED IN THE STRUCTURAL COMPONENTS OF FUSION REACTORS. IF NIOBIUM IS EMPLOYED AS THE STRUCTURAL MATERIAL, DISPOSAL SCHEMES SIMILAR TO THOSE CURRENTLY PROPOSED FOR FISSION REACTOR WASTES MAY BE REQUIRED. IF VANADIUM IS EMPLOYED, RECYCLE OF THE STRUCTURAL MATERIAL APPEARS POSSIBLE. (4) ALTHOUGH AFTERHEAT REMOVAL WILL BE QUANTITATIVELY LESS OF A PROBLEM WITH FUSION POWER THAN WITH FISSION POWER, IT MUST BE CONSIDERED IN THE ENGINEERING DESIGN OF FUSION REACTORS.

13-5-3-366 INSTRUMENTATION AND AUTOMATIC CONTROL SYSTEMS - THE 26TH ISA CONFERENCE AND EXHIBIT
LISSER, C. S. + EADS, B. G. + DUGGINS, B. C.
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE
THE 26TH INSTRUMENT SOCIETY OF AMERICA CONFERENCE AND EXHIBIT PRESENTED A REVIEW OF THE STATE OF THE TECHNOLOGY OF THE INDUSTRY AND A SUGGESTION OF THINGS TO COME. A BROAD RANGE OF TOPICS CONCERNING INSTRUMENTATION THEORY AND APPLICATION WAS CONSIDERED IN THE 92 TECHNICAL SESSIONS COMPRISING THE CONFERENCE PROGRAM. AN INNOVATION THIS YEAR WAS A SERIES OF DISTINGUISHED LECTURES ON SPECIAL AREAS OF INSTRUMENTATION. CONCERN ABOUT INTERNATIONAL STANDARDS HIGHLIGHTED THE ECONOMIC

ASPECT, AND MORE RESEARCH AND DEVELOPMENT WERE ACKNOWLEDGED TO BE NEEDED IN THE ENVIRONMENTAL FIELD. SOME NEW WORK WAS REPORTED ON THE STUDY OF VIBRATION AND ITS EFFECTS IN AND ON NUCLEAR PLANTS. SELECTED PAPERS OF PARTICULAR SAFETY SIGNIFICANCE ARE REVIEWED.

13-5-4-373 GENERAL STRUCTURAL DESIGN CRITERIA FOR PWR CONTAINMENT INTERIOR STRUCTURES
SIMEIL, I. S.
WECHTEL CORPORATION, GAITHERSBURG, MARYLAND
THE CONTAINMENT INTERIOR STRUCTURES OF PRESSURIZED WATER REACTORS HAVE SEVERAL SAFETY FUNCTIONS FOR WHICH THEIR STRUCTURAL INTEGRITY IS OF UTMOST IMPORTANCE. BY PROVIDING SUPPORT DURING PLANT OPERATION AND POSTULATED EARTHQUAKES, THEY HELP PREVENT THE OCCURRENCE OF A LOSS OF COOLANT ACCIDENT. FURTHERMORE, IF AN ACCIDENT DOES OCCUR, THEY HELP MITIGATE ITS CONSEQUENCES BY PROTECTING THE CONTAINMENT AND ALL THE PROVIDED ENGINEERED SAFETY FEATURES FROM JET FORCES, WHIPPING PIPES, DIFFERENTIAL PRESSURES, AND MISSILES. THE PROBLEMS AND COMPLEXITY OF COMBINING SYSTEM AND STRUCTURAL REQUIREMENTS IN ARRIVING AT A CONSERVATIVE AND YET ECONOMICAL DESIGN WARRANT A GENERAL DISCUSSION OF THE CRITERIA INVOLVED AND OF THE SPECIAL DYNAMIC STRUCTURAL PROBLEMS ENCOUNTERED.

13-5-5-389 SYMPOSIUM ON RADIOECOLOGY APPLIED TO THE PROTECTION OF MAN AND HIS ENVIRONMENT
SMEETS, J. G. P. M. + BERLIN, A. + AMAVIS, R. J.
COMMISSION OF EUROPEAN COMMUNITIES, LUXEMBOURG
THIS SYMPOSIUM, ORGANIZED BY THE COMMISSION OF THE EUROPEAN COMMUNITIES, WAS DEVOTED TO THE ASSESSMENT OF THE ACHIEVEMENTS OF RADIOECOLOGY IN THE PROTECTION OF MAN AGAINST RADIOACTIVE POLLUTANTS (AREAS STILL IN NEED OF RESEARCH WERE DEFINED) AND TO THE DETERMINATION OF THE EXTENT TO WHICH THE KNOWLEDGE GAINED IN RADIOECOLOGY CAN BE APPLIED TO THE FIGHT AGAINST NONRADIOACTIVE POLLUTANTS. ONE OF THE CONCLUSIONS WAS THAT THE CONCEPT OF 'RADIOECOLOGICAL FORECASTING' SHOULD BE INTRODUCED, ALLOWING FOR LONG TERM PLANNING IN THE SETTING UP OF NEW NUCLEAR INSTALLATIONS. MANY OF THE CONCEPTS DEVELOPED IN RADIOECOLOGY FIND THEIR PLACE IN THE FIGHT AGAINST NONRADIOACTIVE POLLUTANTS. THE NOTION OF 'ENGAGED DAMAGE' CAN BE USED FOR THE DEVELOPMENT OF 'CRITERIA' AND 'GUIDE LEVELS' IN THE ESTABLISHMENT OF REGULATIONS.

13-5-5-391 ATMOSPHERIC TRANSPORT AND DISPERSION OVER CITIES
GIFFORD, F. A., JR.
AIR RESOURCES ATMOSPHERIC TURBULENCE AND DIFFUSION LABORATORY, OAK RIDGE, TENNESSEE
IN CITIES, ATMOSPHERIC DISPERSION AND TRANSPORT OF POLLUTANTS ARE AFFECTED BY SEVERAL FACTORS THAT ARE NOT PRESENT IN THE NONURBAN ENVIRONMENT, PRINCIPALLY THE ENHANCED SURFACE ROUGHNESS AND HEAT CAPACITY. THE EFFECTS OF THESE ON THE MICROMETEOROLOGY OF THE URBAN ATMOSPHERIC BOUNDARY LAYER ARE BRIEFLY SUMMARIZED, AND DIFFUSION MODELS FOR URBAN SOURCES ARE REVIEWED. THE BOUNDARY LAYER OVER A CITY IS USUALLY NEARLY ADIABATIC. DISPERSION IS ENHANCED BY THE INCREASED URBAN ROUGHNESS, ALTHOUGH TRANSPORT BY THE MEAN WIND IS SLIGHTLY DECREASED BY THE AERODYNAMIC DRAG. SUCH REMOVAL PROCESSES AS FALLOUT AND PRECIPITATION SCAVENGING, AS WELL AS CHEMICAL REACTIONS, ARE BRIEFLY DISCUSSED.

13-6-1-451 ISPRAS CONTRIBUTION TO REACTOR SAFETY
HANDLES, J.
JOINT CENTRE FOR NUCLEAR RESEARCH, ISPRA (VARESE), ITALY
EURATOMS JOINT RESEARCH CENTRE AT ISPRA HAS HAD FOR SEVERAL YEARS AN EXTENSIVE PROGRAM IN REACTOR SAFETY RESEARCH AND DEVELOPMENT. IN THE FAST REACTOR SAFETY FIELD, IT INCLUDED WORK ON THE INTERACTION BETWEEN URANIUM DIOXIDE AND SODIUM AND ON THE DYNAMIC LOADING OF LIQUID METAL COOLED FAST BREEDER REACTOR CONTAINMENT. RESEARCH IN SUPPORT OF WATER REACTOR SAFETY COVERS DEPRESSURIZATION AND EMERGENCY CORE COOLING SYSTEM STUDIES. A MORE GENERALIZED RESEARCH EFFORT IS UNDER WAY IN THE AREAS OF REACTOR DYNAMICS, RELIABILITY THEORY, EARLY FAILURE DETECTION, AND FRACTURE MECHANICS AND PIPE RUPTURE.

13-6-2-459 RADIOLYTIC HYDROGEN GENERATION AFTER LOSS OF COOLANT ACCIDENTS IN WATER COOLED POWER REACTORS
ZITTEL, H. E.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE RADIOLYTIC GENERATION OF HYDROGEN FROM THE PRESSURE SUPPRESSION COOLANT LIQUID FOLLOWING A LOSS OF COOLANT ACCIDENT IN LIGHT WATER COOLED POWER REACTORS IS AN IMPORTANT CONSIDERATION SINCE IT COULD CONCEIVABLY RESULT IN A HAZARDOUS CONDITION. STUDIES CARRIED OUT IN THIS LABORATORY ON THE PROBABLE RADIOLYTIC HYDROGEN GENERATION IN BOTH THE PWR AND BWR ACCIDENT CASES HAVE BEEN INSTRUMENTAL IN ESTABLISHING A BASE FROM WHICH TO CONSIDER THIS POINT. A REVIEW OF THE EXPERIMENTAL WORK AND THE CONCLUSIONS ARISING FROM THE WORK ARE GIVEN.

13-6-2-467 SOME PRELIMINARY CONSIDERATIONS RELATING TO AN EQUATION OF STATE FOR IRRADIATED NUCLEAR FUEL
BROOK, A. J.
UNITED KINGDOM ATOMIC ENERGY AUTHORITY, RISLEY, WARRINGTON, LANCS
THE CALCULATION OF ENERGY RELEASE RESULTING FROM SEVERE EXCURSIONS IN FAST REACTORS DEMANDS A KNOWLEDGE OF THE EQUATION OF STATE OF REACTOR FUEL. THIS ARTICLE DISCUSSES THE MODIFYING EFFECTS THAT FISSION PRODUCTS MAY PRODUCE ON PRESSURE

TEMPERATURE RELATIONS AND OUTLINES SOME OF THE MAJOR UNCERTAINTIES IN THE PHYSICAL AND CHEMICAL BEHAVIOR OF THE FISSION PRODUCTS. ATTENTION IS DRAWN TO THE IMPORTANCE OF REACTOR CONDITIONS AT THE INITIATION OF THE SUPERPROMPT EXCURSION, AND AN INDICATION IS GIVEN OF THE EFFECTS OF FISSION PRODUCT PRESSURES ON NUCLEAR EXCURSION YIELDS AND CONTAINMENT REQUIREMENTS.

13-6-4-478 EFFECT OF RUPTURE IN A PRESSURIZED NOBLE GAS ADSORPTION BED
UNDERHILL, D. W.
HARVARD SCHOOL OF PUBLIC HEALTH, BOSTON, MASS.
THEORETICAL AND EXPERIMENTAL STUDIES SHOW THAT, IN THE EVENT OF AN ACCIDENTAL RUPTURE OF A PRESSURIZED NOBLE GAS ADSORPTION BED, (1) THE FRACTIONAL RELEASE OF ADSORBED FISSION GASES CAN BE SMALLER THAN THE RATIO OF THE INITIAL-TO-FINAL BED PRESSURES, (2) FOR A GIVEN SET OF CONDITIONS, THE FRACTION OF KRYPTON RELEASED WILL BE GREATER THAN THAT OF XENON, AND (3) WHERE THE LEAK IS RELATIVELY SLOW AND THE CARRIER GAS IS ARGON, AS IN THE PROPOSED FAST FLUX TEST FACILITY DESIGN, THE FRACTION OF FISSION GASES ESCAPING CAN BE SIGNIFICANTLY SMALLER THAN THAT OF THE CARRIER GAS.

13-6-5-482 THE EMERGING ROLE OF THE CAMPUS RADIATION SAFETY OFFICER
ZIEMER, P. L.
PURDUE UNIVERSITY, LAFAYETTE, INDIANA
UNIVERSITY RADIATION SAFETY OFFICERS (RSOS) FROM THROUGHOUT THE UNITED STATES AND CANADA MET AT PURDUE UNIVERSITY IN SEPTEMBER 1971 TO EXAMINE THEIR ROLE ON THE CAMPUS AND HOW THIS ROLE IS CHANGING. THE CONFERENCE FOCUSED PRIMARILY ON ADMINISTRATIVE ASPECTS OF CAMPUS RADIATION SAFETY PROGRAMS BUT ALSO INCLUDED DISCUSSIONS OF PRACTICAL HEALTH PHYSICS PROBLEMS COMMON TO THE CAMPUSES. A WIDE DIVERSITY WAS SEEN IN THE ORGANIZATIONAL STRUCTURES AND RESPONSIBILITIES OF THE MANY UNIVERSITIES REPRESENTED. THE CAMPUS RSO PARTICIPATES IN HEALTH PHYSICS ADMINISTRATION, TEACHING, AND RESEARCH. FINDING THE PROPER BALANCE OF THESE FUNCTIONS IN AN ORGANIZATIONALLY SOUND FRAMEWORK WILL PERMIT HIM TO FILL HIS ROLE IN MEETING THE GROWING HEALTH PHYSICS NEEDS OF HIS CAMPUS IN THE FUTURE.

14-1-1-001 EARTHQUAKE RESISTANT DESIGN OF ENGINEERING STRUCTURES
BELL, C. G.
UNIVERSITY OF NORTH CAROLINA, CHARLOTTE, NORTH CAROLINA
A 2-WEEK MEETING ON EARTHQUAKE-RESISTANT DESIGN OF ENGINEERING STRUCTURES, HELD AT THE UNIVERSITY OF CALIFORNIA, BERKELEY, JUNE 19-30, 1972, IS SUMMARIZED. THE PRINCIPAL TOPICS COVERED INCLUDE SEISMOLOGY AND STRONG-MOTION RECORDS, RESPONSE OF SOILS AND DAMS, FINITE ELEMENT APPLICATIONS IN STRUCTURES AND FOUNDATIONS, A NEW LARGE SHAKER, AND PROBABILISTIC DESIGN. CONSIDERABLE INFORMATION WAS PRESENTED THAT WILL BE USEFUL AS BACKGROUND IN SITING AND EARTHQUAKE-RESPONSE CONSIDERATIONS FOR NUCLEAR REACTORS.

14-1-1-006 THE REGULATION OF THE ENVIRONMENTAL EFFECTS OF NUCLEAR POWER PLANTS
DAVIS, J. P.
CONSOLIDATED EDISON COMPANY, NEW YORK, N. Y.
THIS IS THE FIRST OF A SERIES OF TWO ARTICLES, AND IT PRESENTS A SURVEY OF THE REGULATION OF ENVIRONMENTAL FEATURES OF NUCLEAR POWER PLANTS. RECEIVING PARTICULAR ATTENTION IS THE JURISDICTION OF THE ATOMIC ENERGY COMMISSION UNDER THE ATOMIC ENERGY ACT OF 1954, AND ITS EXPANSION UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969. SEVERAL OTHER FEDERAL AGENCIES, INCLUDING THE FEDERAL POWER COMMISSION, THE CORPS OF ENGINEERS, AND THE ENVIRONMENTAL PROTECTION AGENCY, ALSO PLAY IMPORTANT ROLES IN THIS AREA. IN ADDITION, THERE HAVE BEEN INTERESTING RECENT DEVELOPMENTS IN THE STATE REGULATORY PICTURE IN THE FIELD OF POWER PLANT SITING.

14-1-2-014 PROBABILITY ANALYSIS APPLIED TO LIGHT WATER REACTORS - LOSS OF COOLANT ACCIDENTS
LINDACKERS, K-H + STOEBEL, W.
TECHNICAL SURVEILLANCE ORGANIZATION, RHEINLAND, FEDERAL REPUBLIC OF GERMANY
IN THE PAST, IT HAS BEEN THE PRACTICE IN THE FEDERAL REPUBLIC OF GERMANY TO BASE SITE SELECTION AND ENGINEERING SAFEGUARDS FOR NUCLEAR POWER PLANTS ON THE SO-CALLED MAXIMUM CREDIBLE ACCIDENT CONCEPT (MCA CONCEPT). IN THE OPINION OF THE AUTHORS, IT WILL NOW BE NECESSARY TO USE A MORE QUANTITATIVE APPROACH, AS DEVELOPED BY THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY, BECAUSE NUCLEAR POWER PLANTS MUST BE CONSTRUCTED IN MORE DENSELY POPULATED AREAS. WITH RESPECT TO LIGHT WATER REACTORS, LOSS OF COOLANT ACCIDENTS COULD LEAD TO A RELATIVELY HIGH RELEASE OF FISSION PRODUCTS. IN THIS ARTICLE THE PROBABILITY ANALYSIS IS APPLIED TO LOSS OF COOLANT ACCIDENTS IN THE NUCLEAR POWER PLANTS OF WURGASSEN (BWR) AND STADE (PWR), WHICH ARE NOW UNDER CONSTRUCTION. THE INFLUENCE OF UNCERTAINTIES IN THE MAIN FACTORS OF THIS ANALYSIS (E.G., PROBABILITY OF FAILURES IN PIPING AND CONTAINMENT) IS DISCUSSED.

14-1-3-021 HUMAN ENGINEERING FACTORS IN CONTROL BOARD DESIGN FOR NUCLEAR POWER PLANTS
HAUDENBUSH, M. M.
GULF GENERAL ATOMIC, INC., SAN DIEGO, CALIFORNIA
CONTROL BOARD LAYOUT DESIGN TRENDS IN THE NUCLEAR POWER INDUSTRY ARE EXAMINED AND EVALUATED FROM A HUMAN ENGINEERING ASPECT. EXTENSIVE REVIEW OF EXISTING LITERATURE AND STUDY OF PRESENT CONTROL BOARD LAYOUT PHILOSOPHY SUBSTANTIATE THE SUGGESTION THAT A GREAT NEED EXISTS WITHIN THE NUCLEAR POWER INDUSTRY FOR CONTROL BOARD LAYOUT STANDARDS BASED ON FORMAL HUMAN ENGINEERING STUDIES. RESULTS OF A DETAILED HUMAN ENGINEERING EVALUATION OF A MINIATURIZED CONTROL BOARD ARE PRESENTED TO DEMONSTRATE BOTH THE ADVANTAGES AND DISADVANTAGES OF SIZE REDUCTION. FINALLY, A SUBJECTIVE DISCUSSION OF OPERATOR-AUTOMATION INTERFACES SUGGESTS THE DIRECTION FUTURE CONTROL BOARD DESIGN SHOULD TAKE TO ASSURE OPTIMUM OPERATOR CONTROL AND SAFETY.

14-1-6-027 SAFETY EXPERIENCE GAINED FROM RAPSODIE OPERATION
ARGOUS, J. P. + CHANTOT, M. + PETIT, J. +
STACHURA, S. J.
COMMISSARIAT A L'ENERGIE ATOMIQUE, SAINT PAUL, LEZ, FRANCE +
ATOMICS INTERNATIONAL, CANOGA PARK, CALIF.
THIS ARTICLE BRIEFLY DESCRIBES AND ANALYZES THREE OPERATIONAL INCIDENTS AT THE FRENCH EXPERIMENTAL FAST REACTOR RAPSODIE. THESE EVENTS SERVED TO IDENTIFY VARIOUS DESIGN INADEQUACIES TO BE AVOIDED IN FUTURE PLANTS AND ALSO DEMONSTRATED SEVERAL POSITIVE SAFETY ASPECTS OF THE DESIGN. THE INCIDENTS INVOLVED (1) SODIUM OVERFLOW THROUGH PENETRATIONS IN A SMALL ROTATING PLUG AS A RESULT OF INADVERTENT REACTOR COVER-GAS OVERPRESSURE, (2) A FUEL-HANDLING INCIDENT THAT RESULTED IN DEFORMATION OF HANDLING MECHANISMS AND CORE ASSEMBLIES, AND (3) OVERFLOW OF A FUSIBLE METAL SEAL IN A SMALL ROTATING PLUG DUE TO A PRESSURIZATION ANOMALY. THE INCIDENTS GENERALLY INVOLVED COMBINATIONS OF DESIGN, EQUIPMENT, PROCEDURAL, OR OPERATIONAL ERRORS.

14-2-1-079 SAFETY ASSESSMENT PHILOSOPHY OF THE FAST FLUX TEST FACILITY
FFTF PROJECT PERSONNEL
HANFORD ENGINEERING DEVELOPMENT LABORATORY, RICHLAND, WASH.
THIS REPORT EXPLAINS HOW SAFETY HAS BEEN EMPHASIZED THROUGHOUT THE FAST FLUX TEST FACILITY (FFTF) PROJECT AS AN INTEGRAL PART OF THE TOTAL PROJECT EFFORT FROM THE INCEPTION OF DESIGN THROUGHOUT ALL ASPECTS OF THE ENGINEERING, CONSTRUCTION, TESTING, OPERATION, AND MAINTENANCE OF THE PLANT. THIS OVERALL CONCEPT IS EXPRESSED IN TERMS OF THREE LEVELS OF SAFETY. THE FIRST LEVEL ADDRESSES THE PREVENTION OF ACCIDENTS THROUGH THE INTRINSIC FEATURES OF THE DESIGN OF THE PLANT AND THE QUALITY, REDUNDANCY, TESTABILITY, INSPECTABILITY, AND FAIL SAFE FEATURES OF THE COMPONENTS OF THE REACTOR AND PLANT. THE SECOND LEVEL CONCERNS PROVIDING PROTECTION AGAINST SUCH INCIDENTS AS REACTIVITY INSERTIONS OR FAILURES OF PARTS OF THE CONTROL SYSTEM WHICH MIGHT OCCUR IN SPITE OF THE CARE TAKEN IN DESIGN, CONSTRUCTION, AND OPERATION TO PREVENT THEM. THE THIRD LEVEL OF SAFETY SUPPLEMENTS THE FIRST TWO THROUGH FEATURES THAT ADD MARGIN IN THE PLANT DESIGN AS ADDITIONAL ASSURANCE THAT PROTECTION TO THE PUBLIC IS PROVIDED EVEN IN THE EVENT OF THE OCCURRENCE OF EXTREMELY UNLIKELY AND UNFORESEEN CIRCUMSTANCES. ALSO INCLUDED IN THE DISCUSSION ARE THE PRINCIPAL FFTF DESIGN PARAMETERS AND THE REACTOR'S INHERENT SAFETY FEATURES. THE PROGRAMS OF TESTING AND DEVELOPMENT TO SUPPORT THE DESIGN, AND THE CARE USED IN CONSTRUCTION AND TESTING.

14-2-2-091 COUPLED NEUTRONICS HYDRODYNAMICS METHODS
TOBIAS, M.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE PRINCIPAL FEATURES OF COMPUTER CODES AND METHODS FOR REACTOR DISASSEMBLY ANALYSIS ARE BRIEFLY SURVEYED. FROM THE BASICALLY HAND CALCULATED METHOD OF BETHE AND TAIT, THESE METHODS HAVE PROGRESSED TO FAIRLY ELABORATE PROGRAMS DESIGNED TO ESTIMATE THE CONSEQUENCES OF A HYPOTHETICAL FAST REACTOR CORE DISASSEMBLY. SUCCESSIVE DEVELOPMENTS HAVE INCLUDED SUCH FEATURES AS DOPPLER FEEDBACK, DELAYED NEUTRONS, IMPROVED EQUATIONS OF STATE, AND MORE ELABORATE GEOMETRIES.

14-2-3-045 OBSTACLES TO COMPLETE AUTOMATION OF REACTOR CONTROL
EPLER, E. P. + OAKES, L. C.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
ANOMALOUS REACTIVITY CHANGES RESULTING FROM CONDITIONS OTHER THAN ANTICIPATED CONTROL ROD MOTION OCCURRED IN EARLY EXPERIMENTAL REACTORS AND LED TO LOCAL MELTING. DOUBT HAS BEEN EXPRESSED, HOWEVER, THAT SUCH CHANGES COULD OCCUR IN COMMERCIAL POWER REACTORS. DEFENSES AGAINST THE REACTIVITY ANOMALY HAVE SINCE BEEN DEVELOPED FOR TEST AND PRODUCTION REACTORS WHICH HAVE PERMITTED AN INCREASED DEGREE OF AUTOMATION TO BE SAFELY APPLIED. THE PRINCIPLES SO DEVELOPED, WHICH RELY ON DIGITAL TECHNIQUES, ARE EQUALLY APPLICABLE TO POWER REACTORS. ACCEPTED CRITERIA FOR THE APPLICATION OF DIGITAL TECHNIQUES TO CONTROL AND PROTECTION SYSTEMS HAVE NOT YET BEEN DEVELOPED, HOWEVER, AN EXTENSION OF EXISTING PRACTICES AND PRECEDENTS SHOULD BE ADEQUATE UNTIL SUCH CRITERIA ARE AVAILABLE.

14-2-3-135 LOW LEVEL ENVIRONMENTAL MONITORING BY FLUCTUATIONS ANALYSIS
THIE, J. A.
CONSULTANT, BARRINGTON, ILL.
A MEANS IS DESCRIBED FOR SEPARTING A REACTOR PLANT'S VARIABLE RADIATION FROM A LARGER AND ALSO VARYING BACKGROUND UTILIZING THE DIFFERING CHARACTER OF FLUCTUATIONS PRESENT. IT IS SHOWN THAT AN ACCURACY OF PLUS OR MINUS 0.9 MR PER YEAR IN THE FENCE LINE DOSE RATE FROM A BOILING WATER REACTOR (BWR) PLUME IS OBTAINABLE FROM RANDOM FLUCTUATION ANALYSIS, IN WHICH THE STANDARD DEVIATION IS THE BASIC MEASUREMENT TOOL. OTHER SPECIFIC APPLICATIONS OF AUTOCORRELATION, CROSS CORRELATION, AND SPECTRAL ANALYSIS TO THE GENERAL PROBLEM OF SIGNAL EXTRACTION IN LOW LEVEL ENVIRONMENTAL MONITORING ARE DISCUSSED.

14-2-4-111 THE TWELFTH AEC AIR-CLEANING CONFERENCE
MUELLER, D. W. + FIRST, M. W.
HARVARD SCHOOL OF PUBLIC HEALTH, BOSTON, MASS.
THE TWELFTH AEC AIR-CLEANING CONFERENCE WAS HELD AUGUST 28-31, 1972, IN OAK RIDGE, TENN. REGISTRATION TOTALED A RECORD 360 PEOPLE, INCLUDING PERSONNEL FROM ESSENTIALLY ALL FACETS OF GOVERNMENT, INDUSTRY, AND EDUCATIONAL INSTITUTIONS, PLUS REPRESENTATIVES FROM SEVEN FOREIGN COUNTRIES. MAJOR TOPICS WERE CURRENT RESEARCH ON AIR AND GAS CLEANING SYSTEMS OF INTEREST TO THE NUCLEAR COMMUNITY AND MORE RECENT CONSIDERATIONS IN THE DESIGN OF SYSTEMS TO RESIST THE EFFECTS OF FIRE, EARTHQUAKES, AND OTHER MECHANICAL STRESSES. ALSO DISCUSSED WERE AIR CLEANING PROBLEMS ASSOCIATED WITH URANIUM MINING, HIGH TEMPERATURE GAS COOLED REACTORS, AND CHEMICAL PROCESSING PLANTS. CLEAR-CUT BENEFITS RESULTING FROM THE CONFERENCE WERE BETTER DEFINITION OF THE MAJOR PROBLEMS CONFRONTING THE PROFESSION AND PROVISION OF AN OPPORTUNITY FOR GROUPS WORKING ON SIMILAR PROBLEMS TO SHARE THEIR MOST RECENT DATA. PROCEEDINGS OF THE CONFERENCE WERE PUBLISHED IN JANUARY 1973.

14-3-1-165 THE REGULATION OF THE ENVIRONMENTAL EFFECTS OF NUCLEAR POWER PLANTS
DAVIS, J. P.
CONSOLIDATED EDISON COMPANY, NEW YORK, N.Y.
PART ONE OF THIS TWO-PART ARTICLE (SEE NUCLEAR SAFETY FOR JANUARY-FEBRUARY 1973) DISCUSSED U. S. NEEDS FOR ELECTRIC POWER AND THE ROLE OF NUCLEAR ENERGY IN MEETING THESE NEEDS. THE MAJOR PORTION OF THE ARTICLE REVIEWED THE REGULATORY PROCESS THAT IS CURRENTLY REQUIRED FOR NUCLEAR POWER PLANTS. PART TWO DISCUSSES THE RADIOLOGICAL AND NONRADIOLOGICAL EFFECTS OF NUCLEAR POWER GENERATION ON THE ENVIRONMENT AND THE MEANS FOR THEIR REGULATION ALONG WITH SOME RELATED CASES AND CONTROVERSIES. PROPOSALS FOR IMPROVEMENTS THROUGH CHANGES IN PROCEDURES AND NEW LEGISLATION ARE ALSO EXAMINED.

14-3-1-181 ACTIVITIES OF THE GERMAN STANDARDS COMMITTEE FOR NUCLEAR TECHNOLOGY
NEIDER, R. J. A.
FEDERAL INSTITUTE OF MATERIALS TESTING, FEDERAL REPUBLIC OF GERMANY
THE INCREASING DEMAND FOR NUCLEAR STANDARDS TO FACILITATE THE SITING, DESIGN, AND LICENSING OF NUCLEAR POWER PLANTS IS EVIDENT IN GERMANY AS IN MOST OTHER COUNTRIES WITH A VIABLE NUCLEAR CAPABILITY. AS A RESULT, THE GERMAN STANDARDS INSTITUTE'S NUCLEAR TECHNOLOGY COMMITTEE HAS RECENTLY INTENSIFIED ITS EFFORT. IN ADDITION, SEVERAL GERMAN TECHNICAL SOCIETIES ARE INVOLVED IN THE STANDARDIZATION EFFORT, AND GERMANY COOPERATES IN THE INTERNATIONAL STANDARDS ORGANIZATION ACTIVITIES.

14-3-2-187 PROBABILITY OF DAMAGE TO NUCLEAR COMPONENTS DUE TO TURBINE FAILURE
BUSH, S. H.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
THE PROBABILITY OF SIGNIFICANT DAMAGE TO CRITICAL COMPONENTS OF A NUCLEAR REACTOR SYSTEM DUE TO TURBINE FAILURE HAS BEEN ASSESSED BY DETERMINING THE COMBINED PROBABILITIES OF TURBINE FAILURE AND EJECTION OF AN ENERGETIC MISSILE (P1), ON THE BASIS OF 70,000 TURBINE YEARS OF OPERATION, A MISSILE FROM THE TURBINE STRIKING A CRITICAL COMPONENT (P2), AND SIGNIFICANT DAMAGE OCCURRING TO THE COMPONENT (P3). THE OVERALL PROBABILITY (P4) IS AN INDICATION OF HOW MUCH THE NUCLEAR PLANT DESIGNER NEEDS TO BE CONCERNED WITH THE TURBINE MISSILE PROBLEM. TURBINE FAILURES WERE REVIEWED TO ESTABLISH RELEVANCE WITH REGARD TO CURRENT PRACTICE IN DESIGN, FABRICATION, AND OPERATION OF NUCLEAR STEAM TURBINES. IF P1 IS 10(-4) PER YEAR, P2 IS 10(-3) FOR STRIKE ON A 1200 SQUARE FT. AREA, AND P3 APPROACHES 1, THEN P4 IS APPROXIMATELY 10(-7) IF P2 INCREASES, EVALUATION OF P3 BECOMES NECESSARY.

14-3-2-201 FACTORS LIMITING PROMPT-CRITICAL EXCURSIONS IN IRRADIATED FAST REACTOR CORES
TEAGUE, M. J. + MATHER, D. J.
UNITED KINGDOM ATOMIC ENERGY AUTHORITY, CULCHETH, NR. WARRINGTON, LANCS
PRELIMINARY CALCULATIONS ARE REPORTED WHICH ILLUSTRATE HOW PRESSURES FROM FISSION PRODUCTS IN IRRADIATED FUEL WOULD DRASTICALLY REDUCE THE EXPLOSIVE ENERGY RELEASE IN A FAST REACTOR SUBJECTED TO A FAST REACTIVITY RAMP. ADDITIONAL EMPHASIS IS PUT ON THE REDUCTION OF DAMAGING EFFECTS DUE TO RAPID GENERATION OF SODIUM VAPOR FOR THREE REASONS - LOWER FUEL TEMPERATURES AT CORE DISASSEMBLY, LESS VIOLENT INTERNAL DISASSEMBLY PROCESSES, AND GAS BLANKETING OF FUEL PARTICLES.

14-3-3-209 STANDBY EMERGENCY POWER SYSTEMS 1. THE EARLY PLANTS
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
AVAILABILITY OF RELIABLE STANDBY OR EMERGENCY POWER SYSTEMS HAS ALWAYS BEEN A PRIME CONSIDERATION IN STATION DESIGN, BEGINNING WITH THE EARLY NUCLEAR REACTOR POWER PLANTS. THE DOCUMENTED OPERATING EXPERIENCES WERE REVIEWED FOR THE STATION OFF-SITE AND ON-SITE STANDBY, EMERGENCY A-C POWER SOURCES, AND THE BATTERY SYSTEMS. PART 1 DISCUSSES THESE SYSTEMS FOR THE GENERATING REACTORS COMMISSIONED ABOUT 1959-1967. THE ABILITY OF THESE SYSTEMS TO PERFORM SATISFACTORILY WHEN NEEDED HAS BEEN VERY GOOD FOR THE EARLY PLANTS, BUT THE ABILITY TO PERFORM SATISFACTORILY AT ANY GIVEN TIME WAS SOMETHING LESS. HOWEVER, WITH THE ADVANCEMENT OF REGULATORY DESIGN GUIDES AND INDUSTRY STANDARDS, THE RELIABILITY IS EXPECTED TO CONTINUE TO BE GOOD AND THE AVAILABILITY TO BE IMPROVED. IN THE LATER PLANTS, TO BE DISCUSSED IN PART 2, WITH STANDARDIZED AND MODULARIZED DESIGNS, THESE EFFORTS AND EFFECTS WILL BECOME APPARENT THROUGH BETTER USE, TESTING, AND DOCUMENTATION.

14-3-5-220 SHOULD MEDICAL RADIATION EXPOSURE BE RECORDED FOR RADIATION WORKERS
EASON, C. F. + BROOKS, B. G.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
IT HAS BEEN STATED THAT THE AVERAGE YEARLY OCCUPATIONAL RADIATION EXPOSURE OF A RADIATION WORKER IS COMPARABLE TO THAT OF NATURAL BACKGROUND (THAT IS, 120 TO 150 MREMS). THUS THERE IS NO NEED TO ASSESS THE WORKER'S MEDICAL RADIATION EXPOSURE TO ENSURE HIS OK ON THE JOB HEALTH AND SAFETY. ON THE OTHER HAND, THERE ARE THOSE WHO BELIEVE THAT, IF A WORKER HAS UNDERGONE A LARGE THERAPEUTIC EXPOSURE, IT MAY BE DESIRABLE TO RESTRICT FUTURE OCCUPATIONAL EXPOSURE WHERE THE RISK OF A LARGE ACCIDENTAL EXPOSURE MAY BE UNUSUALLY HIGH. IT HAS ALSO BEEN STATED THAT, ALTHOUGH THE RADIATION DOSE RESULTING FROM MEDICAL EXPOSURE SHOULD NOT, IN GENERAL, BE INCLUDED IN DOSE LIMITATIONS, IT WOULD NEED TO BE TAKEN INTO ACCOUNT IN ANY ASSESSMENT OF THE TOTAL RISK TO THE INDIVIDUAL FROM RADIATION EXPOSURE. IN VIEW OF THE APPARENT DIFFERENCES OF OPINION ON THE VALUE OF NOTING MEDICAL RADIATION EXPOSURES, IS THERE A NEED FOR A RECORD-KEEPING SYSTEM THAT WILL PROVIDE MANAGEMENT, LABOR, AND THE MEDICAL PROFESSION WITH THE INFORMATION NECESSARY TO WEIGH THE TOTAL RISK OF A WORKER EXPOSED TO A SOURCE OF IONIZING RADIATION. THIS ARTICLE REVIEWS VARIOUS ASPECTS RELATING TO THIS QUESTION.

14-4-1-267 PUBLIC HEALTH RISKS OF THERMAL POWER PLANTS
STARR, C. + GREENFIELD, M. A.
UNIVERSITY OF CALIFORNIA AT LOS ANGELES, LOS ANGELES, CALIF.
THE RESULTS OF A STUDY COMPARING NUCLEAR POWER PLANTS WITH OIL FIRED PLANTS ARE REVIEWED AND ASSESSED IN TERMS OF PUBLIC HEALTH RISKS. THE STUDY WAS UNDERTAKEN AS A BASIC CONTRIBUTION TO THE STATE OF CALIFORNIA'S LONG RANGE PLANNING ON HOW BEST TO MEET THE POWER NEEDS OF ITS GROWING POPULATION. BASED ON AN 8-MONTH EVALUATION OF OIL FIRED AND NUCLEAR PLANTS IN URBAN SETTINGS, THE AUTHORS CONCLUDE THAT THE PUBLIC HEALTH RISK FROM EITHER TYPE OF PLANT IS ROUGHLY COMPARABLE TO THE HAZARDS TO WHICH THE PUBLIC IS EXPOSED BY UNCONTROLLABLE NATURAL EVENTS - LIGHTNING, INSECT OR SNAKE BITES, ETC. SUCH DEATHS OCCUR AT AN ANNUAL RATE OF APPROXIMATELY ONE PER MILLION OF POPULATION. A COMPARISON OF THE RISK FACTORS IN ROUTINE OPERATION OF DIFFERENT TYPES OF POWER PLANTS SHOWED THAT PUBLIC HEALTH RISKS FROM NUCLEAR PLANTS AVERAGED LESS THAN ONE-TENTH OF THE RISKS FROM OIL FIRED PLANTS.

14-4-1-274 THIRD INTERNATIONAL SYMPOSIUM ON PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS
PRYOR, W. A.
USAEC OAK RIDGE OPERATIONS, OAK RIDGE, TENN.
THE THIRD INTERNATIONAL SYMPOSIUM ON PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS WAS HELD IN RICHLAND, WASH., AUG. 16-20, 1971. ALL PHASES OF TRANSPORTATION WERE COVERED IN THE 93 PAPERS PRESENTED, AND THERE WERE OVER 450 REGISTRANTS REPRESENTING 17 NATIONS. HIGHLIGHTS OF THE MANY TOPICS DISCUSSED IN BOTH THE FORMAL AND INFORMAL SESSIONS ARE REVIEWED IN THIS ARTICLE.

14-4-2-291 PRESSURIZED WATER REACTOR LOSS OF COOLANT ACCIDENTS BY HYPOTHETICAL VESSEL RUPTURE
DOAN, P. L. + LANNING, D. D. + RASMUSSEN, N. C.
UNITED ENGINEERS AND CONSTRUCTORS, PHILADELPHIA, PA. +
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.
THE UNLIKELY LOSS OF COOLANT BY SOME TYPES OF POSTULATED PRESSURE VESSEL RUPTURES IN A LARGE, FOUR-LOOP 2758-MW(T) PRESSURIZED WATER REACTOR HAS BEEN STUDIED TO ASSESS THE RELATIVE IMPORTANCE AND CONSEQUENCES OF PRINCIPAL BLOWDOWN PROCESSES. THE COMPUTER CODES WHAM AND RELAP3 HAVE BEEN EMPLOYED AS THE PRINCIPAL TOOLS OF ANALYSIS. A LARGE NUMBER OF COMPUTER RUNS HAVE BEEN MADE WITH VARYING PARAMETERS SUCH AS BREAK TIME, BREAK LOCATION, BREAK SIZE, FUEL CLADDING GAP CONDUCTANCE, EMERGENCY CORE COOLING INJECTION MODES, VOID COEFFICIENTS, AND PHASE SEPARATION MODELS. CLEAR PATTERNS ARE OBSERVED ON THE ASYMPTOTIC BEHAVIOR OF MANY BLOWDOWN PARAMETERS.

14-4-2-334 PHENOMENOLOGICAL RESEARCH IN LMFBR ACCIDENT ANALYSIS
KELBER, C. N.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILL.
CURRENT NEEDS FOR, AND PROGRAMS OF, PHENOMENOLOGICAL RESEARCH APPLIED TO PROBLEMS IN ACCIDENT ANALYSIS OF LIQUID METAL COOLED FAST BREEDER REACTORS ARE REPORTED. THIS SURVEY IS RESTRICTED TO PHENOMENA INVOLVED IN ANALYSIS OF HYPOTHETICAL ACCIDENTS - SODIUM VOIDING - COOLANT DYNAMICS, FUEL DYNAMICS, FUEL FAILURE PROPAGATION, FUEL COOLANT INTERACTION, POSTACCIDENT HEAT REMOVAL, VESSEL AND PLUG RESPONSE, SODIUM FIRES AND AEROSOLS, AND FISSION PRODUCT TRANSPORT. REPORTED FOR EACH CASE ARE THE CURRENT NEED, THE STATUS, THE CURRENT PROGRAM, AND THE ULTIMATE OBJECTIVE OF THE APPLICABLE RESEARCH. THE SURVEY INDICATES THAT IN THE RELATIVELY NEAR TERM AN IMPROVED BASIS FOR DESCRIBING AND PREDICTING THE COURSE OF AN ACCIDENT WILL PROBABLY BE DEVELOPED. IT IS MUCH LESS CERTAIN TO WHAT EXTENT IT WILL BE POSSIBLE TO FACTOR THIS UNDERSTANDING INTO PLANT DESIGN IN SUCH A WAY AS TO DECREASE THE NEED FOR STRONG CONTAINMENTS. AN ADVANCED TESTING PROGRAM REQUIRING MUCH LARGER SCALE TESTS MAY BE NEEDED.

14-4-3-315 AN ANALYSIS OF CONTROL ROD SYSTEM MALFUNCTIONS IN NUCLEAR POWER REACTORS
DUMA, D. W. + SAXE, R. F.
NORTH CAROLINA STATE UNIVERSITY, RALEIGH, N. C.
CONTROL ROD SYSTEM FAILURES AND MALFUNCTIONS ARE REVIEWED FOR ALL OF THE NUCLEAR POWER REACTORS FROM INCEPTION TO COMMERCIAL OPERATION THROUGH 1971. FAILURE RATES ARE CALCULATED AND TYPES OF FAULTS ANALYZED FOR COMMON CAUSES. SYSTEM PERFORMANCES ARE COMPARED FOR THE MAJOR VENDORS OF PRESSURIZED AND BOILING WATER REACTORS AS WELL AS OTHERS. RESULTS INDICATE THAT OVERALL FAILURE RATES FOR THE REACTORS CONSIDERED ARE NOT WIDELY VARIANT.

14-4-5-325 CONSEQUENCES OF AN ACCIDENTAL RELEASE OF SODIUM TO THE ENVIRONMENT FROM AN LMFBR
TADMOR, J.
SOREQ NUCLEAR RESEARCH CENTRE, YAVNE, ISRAEL
A THEORETICAL EVALUATION HAS BEEN MADE OF THE CONSEQUENCES OF AN ENVIRONMENTAL RELEASE OF SODIUM IN THE FORM OF AN AIRBORNE CLOUD RESULTING FROM A SODIUM FIRE IN A LIQUID METAL COOLED FAST BREEDER REACTOR. THE EVALUATION TAKES INTO CONSIDERATION ONLY THE HAZARDS OF THE RADIOISOTOPES OF THE SODIUM. PROBLEMS ASSOCIATED WITH ACCOMPANYING FISSION PRODUCTS WERE NOT INCLUDED. ON THE BASIS OF CONSERVATIVE ASSUMPTIONS, THE DATA SHOW THAT THE MOST SIGNIFICANT EXPOSURE WOULD BE TO A CHILD THROUGH THE FORAGE - COW - MILK FOOD CHAIN PATHWAY. THE WHOLE BODY DOSE FOR AN INSTANTANEOUS DIRECT ENVIRONMENTAL RELEASE OF 1 G OF SODIUM (CONTAINING 0.31 CURIES OF SODIUM-24 AND 1.8 X 10(-6) CURIES OF SODIUM-22) WOULD BE ABOUT 0.2 REM. THE CORRESPONDING DOSE RESULTING FROM A RELEASE OF 1000G OF SODIUM WITHIN THE REACTOR CONTAINMENT VESSEL, FOLLOWED BY A SUBSEQUENT CONTAINMENT VESSEL LEAKAGE RATE OF 0.1 PERCENT PER DAY, WOULD BE ABOUT 13 REMS. RESTRICTIONS ON THE USE OF MILK AND MILK PRODUCTS WOULD CONSIDERABLY REDUCE THESE VALUES. OTHER POSSIBLE COUNTERMEASURES THAT MIGHT BE TAKEN TO COPE WITH THE ENVIRONMENTAL HAZARDS ARE ALSO DISCUSSED.

14-4-5-340 SYMPOSIUM ON HEALTH PHYSICS IN THE HEALING ARTS
HART, J. C. + POSTON, J. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE SEVENTH MIDYEAR TOPICAL SYMPOSIUM OF THE HEALTH PHYSICS SOCIETY, HELD IN SAN JUAN, PUERTO RICO, DECEMBER 11-14, 1972, DEALT WITH HEALTH PHYSICS IN THE HEALING ARTS. THE SYMPOSIUM, WHICH INCLUDED OVER 100 TECHNICAL PAPERS, WAS ORGANIZED INTO NINE SESSIONS (INCLUDING TWO PANEL DISCUSSIONS). TOPICS INCLUDED - WHAT DO WE KNOW ABOUT (RADIATION) EFFECTS, RADIATION EXPOSURES IN THE HEALING ARTS, OPERATIONAL HEALTH PHYSICS AND QUALITY CONTROL, TRAINING, THE STATUS AND FUTURE TRENDS OF HEALTH PHYSICS TRAINING, TECHNOLOGICAL ASPECTS, GENERAL, EXPOSURE REDUCTION METHODOLOGY, REGULATION VS STANDARDIZATION, AND QUE PASA. HIGHLIGHTS OF THE TECHNICAL SESSIONS, INCLUDING REFRESHER COURSES AND PANEL DISCUSSIONS, ARE REVIEWED, AND THE COMPLETE SYMPOSIUM AGENDA IS INCLUDED.

14-4-6-356 DENSIFICATION OF REACTOR FUELS
CULBERT, W. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE MOVEMENT OF FUEL AS A CONSEQUENCE OF DENSIFICATION WAS DETERMINED TO BE THE CAUSE FOR COLLAPSE OF THE FUEL CLADDING IN A NUMBER OF PRESSURIZED WATER REACTORS. CLADDING COLLAPSE PRESENTED AN UNEVALUATED CONFIGURATION FOR HEAT REMOVAL IN BOTH NORMAL AND ACCIDENT SITUATIONS. ON NOV. 14, 1972, THE REGULATORY STAFF OF THE U.S. ATOMIC ENERGY COMMISSION ISSUED ITS TECHNICAL REPORT ON DENSIFICATION OF LIGHT WATER REACTOR FUELS. THEN ON FEB. 2, 1973, THE STAFF ISSUED THE REPORT ENTITLED ADDITIONAL TESTIMONY ON POINT BEACH 2 NUCLEAR PLANT IN REGARD TO FUEL DENSIFICATION AND ITS EFFECTS. BECAUSE OF THE INTEREST IN THIS SUBJECT, SUMMARIES OF BOTH OF THESE AEC REPORTS ARE PRESENTED HERE, ALONG WITH THE BIBLIOGRAPHY INCLUDED WITH THE NOVEMBER 14 REPORT.

14-4-6-362 ACTIVITY CONFINEMENT AND DECONTAMINATION AFTER FAILURE OF AN ANTIMONY - BERYLLIUM SOURCE ROD
JOSEPH, J. W., JR. + LITTLE, J. W., JR.
E. I. DU PONT DE NEMOURS AND COMPANY, AIKEN, S. C.
ANTIMONY IN AN IRRADIATED SOURCE ROD MELTED WHILE THE ROD WAS SUSPENDED IN AIR IN THE K REACTOR ROOM AT THE SAVANNAH RIVER PLANT. THE FAILURE RELEASED ABOUT 85,000 CURIES OF ACTIVITY, WHICH WAS DISTRIBUTED IN THE REACTOR ROOM AND THE CONFINEMENT FILTERS IN THE VENTILATION EXHAUST SYSTEM. THE CONFINEMENT FILTERS PREVENTED A SIGNIFICANT ACTIVITY RELEASE, ONLY 3 MILLICURIES ESCAPED TO THE ENVIRONS, AND NO DECONTAMINATION WAS REQUIRED OUTSIDE THE REACTOR BUILDING. DECONTAMINATION OF THE REACTOR ROOM AND REPLACEMENT OF THE CONTAMINATED FILTER COMPARTMENTS REQUIRED ABOUT 3 1/2 MONTHS BEFORE THE REACTOR WAS RETURNED TO NORMAL OPERATION.

14-5-1-439 HEALTH EFFECTS OF ELECTRICITY GENERATION FROM COAL, OIL, AND NUCLEAR FUEL
LAVE, L. B. + FREEBURG, L. C.
CARNEGIE-MELLON UNIVERSITY, PITTSBURGH, PA.
OCCUPATIONAL AND PUBLIC HEALTH EFFECTS OF GENERATING ELECTRICITY FROM COAL, URANIUM, AND OIL ARE COMPARED, WITH PARTICULAR ATTENTION GIVEN TO ACCIDENT AND CHRONIC-DISEASE RATES FOR FUEL EXTRACTION AND AIRBORNE EMISSIONS FROM POWER AND REPROCESSING PLANTS. IT IS CONCLUDED THAT URANIUM OFFERS LESS OF A HEALTH HAZARD AS A FUEL THAN COAL. THE ANALYSIS IS BASED ON CURRENT OPERATING PRACTICE, HOWEVER, ADVANCES IN TECHNOLOGY CAN BE EXPECTED TO REDUCE BOTH THE OCCUPATIONAL AND PUBLIC HEALTH RISKS FROM THESE FUELS.

14-5-1-428 INTERNATIONAL VIEWS ON PRINCIPLES AND STANDARDS OF REACTOR SAFETY
PALMER, J. F.
ATOMIC ENERGY OF CANADA LIMITED, CHALK RIVER, ONTARIO
AN IAEA SYMPOSIUM ON PRINCIPLES AND STANDARDS OF REACTOR SAFETY WAS HELD FEB. 5-9, 1973, AT THE NUCLEAR RESEARCH CENTER, JULICH, FEDERAL REPUBLIC OF GERMANY. THE MEETING WAS ATTENDED BY APPROXIMATELY 250 PARTICIPANTS FROM 30 COUNTRIES, AND 40 PAPERS WERE PRESENTED. THE PAPERS ARE REVIEWED AND THE PANEL DISCUSSION IS SUMMARIZED TO GIVE SOME INSIGHT INTO INTERNATIONAL VIEWS ON THE PROBLEMS RELATED TO REACTOR SAFETY.

14-5-1-439 ANS NATIONAL TOPICAL MEETING ON WATER REACTOR SAFETY
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A TOPICAL MEETING ON WATER REACTOR SAFETY SPONSORED BY THE AMERICAN NUCLEAR SOCIETY, THE ATOMIC INDUSTRIAL FORUM, THE OAK RIDGE NATIONAL LABORATORY, AND THE UNIVERSITY OF UTAH WAS HELD AT SALT LAKE CITY, MAR. 26 TO 28, 1973. THE MEETING WAS ATTENDED BY MORE THAN 360 TECHNICAL SPECIALISTS, WHO HEARD A TOTAL OF 44 PAPERS IN THE FOLLOWING TECHNICAL SESSIONS - ACCIDENT ANALYSIS AND PROBABILITY, FLUID FLOW DURING LOCA, MECHANICAL BEHAVIOR OF MATERIALS, HEAT TRANSFER DURING LOCA, STANDARDS AND SURVEILLANCE, COMPUTER CODES AND APPLICATIONS, PROTECTION FROM NATURAL AND MAN-MADE PHENOMENA, AND COMPARATIVE ANALYSES OF LOCA. OVER HALF OF THE PAPERS AND SESSIONS WERE CONCERNED WITH THE LOSS-OF-COOLANT ACCIDENT. A PANEL DISCUSSION ON, REACTOR SAFETY RESEARCH - WHAT, WHY, HOW, PRESENTED A PLETHORA OF VIEWS ON THE SUBJECT.

14-5-2-446 OZONE FORMATION BY THE RADIOLYSIS OF LIQUID NITROGEN - CALCULATION AND MEASUREMENT
GAULT, J. D. + LOGAN, K. W. + CANNER, H. R.
FEDERAL UNIVERSITY OF SANTA CATARINA, FLORIANOPOLIS, BRAZIL +
UNIVERSITY OF MISSOURI, COLUMBIA, MO.
A SIMPLE EXPERIMENTAL METHOD IS PRESENTED WHICH ALLOWS AN ESTIMATE OF THE AMOUNT OF OZONE PRESENT WHEN OXYGEN CONTAMINATED LIQUID NITROGEN IS EXPOSED TO A RADIATION FIELD. ALSO, IF THE RADIATION LEVEL AND THE OXYGEN CONCENTRATION ARE KNOWN, THE AMOUNT OF OZONE FORMED CAN BE CALCULATED. IN OUR CASE, THERE IS GOOD AGREEMENT. THE RESULTS INDICATE THAT THE CONCENTRATION OF THE OXYGEN IMPURITY IS MUCH LESS SIGNIFICANT THAN PREVIOUSLY SUPPOSED. INSTEAD, THE AMOUNT OF LIQUID NITROGEN REMAINING WHEN THE CRYOSTAT IS REFILLED IS THE PRIMARY FACTOR IN DETERMINING THE MAXIMUM AMOUNT OF OZONE THAT WILL BE PRESENT AT ANY TIME.

14-5-2-452 U.S. STUDIES ON LMFBR FUEL BEHAVIOR UNDER ACCIDENT CONDITIONS
DICKERMAN, C. E.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILL.
THIS ARTICLE PRESENTS A BRIEF REVIEW OF THE U. S. EFFORT, BETWEEN FALL 1969 AND SPRING 1972, RELATING TO EVALUATION OF THE BEHAVIOR OF THE FUEL AND COOLANT IN LIQUID METAL COOLED FAST BREEDER REACTORS UNDER ACCIDENT CONDITIONS. THE EXPERIMENTAL WORK IS CENTERED LARGELY AROUND THE TRANSIENT REACTOR TEST FACILITY. INVESTIGATIONS OF STEADY-STATE POWER OPERATION SUGGEST THAT SAFETY AND RELIABILITY CAN BE ATTAINED EVEN WITH PARTIAL BLOCKAGES OF COOLANT FLOW. RESULTS OF TRANSIENT TESTS ARE LESS SEVERE THAN PREDICTIONS BASED ON PESSIMISTIC ASSUMPTIONS, AND ADDITIONAL EFFORT IS REQUIRED TO PERMIT ACCURATE MODELING OF DETAILED BEHAVIOR.

14-5-3-461 SNEAK-CIRCUIT ANALYSIS
RANKIN, J. P.
THE BOEING COMPANY, HOUSTON, TEXAS
BEGINNING IN LATE 1967, THE BOEING COMPANY IN HOUSTON, TEX., DEVELOPED A COMPUTER AIDED ELECTRICAL SYSTEMS ANALYSIS TECHNIQUE TO HELP ASSURE TROUBLEFREE OPERATION OF NASA'S APOLLO AND SKYLAB HARDWARE. THE TECHNIQUE, CALLED SNEAK-CIRCUIT ANALYSIS, IS BASED ON THE DISCOVERY THAT THERE ARE TOPOLOGICAL CRITERIA THAT ENABLE PRERECOGNITION OF A CIRCUIT TO EXHIBIT UNPLANNED MODES OF OPERATION. THE RESULTS OF SNEAK-CIRCUIT ANALYSIS OVER THE LAST 5 YEARS HAVE SHOWN THAT IT IS NO LONGER NECESSARY TO ACCEPT THE SUPPOSITION THAT A FEW OPERATIONAL SURPRISES ARE INEVITABLE IN COMPLEX ELECTRICAL SYSTEMS. ELECTRICAL SYSTEMS CAN BE MADE FOOLPROOF FROM THE OPERATIONAL POINT OF VIEW. SPECIFICALLY, SNEAK-CIRCUIT ANALYSIS WILL DISCLOSE ALL LATENT CURRENT PATHS, INADVERTENT INHIBITS OR ACTIVATIONS, AMBIGUOUS SYSTEM INDICATIONS, AND MISLEADING CONSOLE LABELS. RELAY RACES, SNEAK GROUNDS, AND POWER SUPPLY CROSSTIES ARE INCLUDED. THIS ARTICLE PRESENTS AN OVERVIEW OF THESE PROBLEMS AND OTHER PRODUCTS OF THE ANALYSIS AS FOUND IN AEROSPACE, COMMERCIAL, AND NUCLEAR SYSTEMS.

14-5-4-470 DESIGN AND EVALUATION OF FFTF CONTAINMENT
SIMPSON, D. E.
WESTINGHOUSE HANFORD COMPANY, RICHLAND, WASH.
THE FAST FLUX TEST FACILITY HAS BEEN THE SUBJECT OF AN EXTENSIVE REGULATORY REVIEW SIMILAR TO THAT FOR POWER REACTOR CONSTRUCTION PERMITS. THE REVIEW EXTENDED FROM SEPTEMBER 1970 TO EARLY 1973, BUT INTERIM AGREEMENTS ALLOWED CONSTRUCTION TO PROCEED WITHOUT DELAY. A MAJOR PART OF THE REVIEW WAS DIRECTED TO THE CONTAINMENT DESIGN AND THE DEFINITION OF APPROPRIATE BASES FOR EVALUATING THE CONTAINMENT FOR THE LIQUID METAL COOLED FAST BREEDER REACTOR SYSTEM. STUDIES OF HYPOTHETICAL ACCIDENTS WERE CARRIED OUT FOR OVERPOWER AND LOSS OF COOLING CIRCUMSTANCES, ARBITRARILY NEGLECTING REACTOR SCRAM. INITIAL STUDIES INDICATED AN ACCIDENT ENERGY OF 150 MW-SEC OF THEORETICALLY AVAILABLE WORK TO BE REASONABLY CONSERVATIVE. MORE RECENT STUDIES, INCORPORATING PRELIMINARY RESULTS OF RESEARCH AND DEVELOPMENT BASED ON THE EARLIER STUDIES, INDICATE THAT A MUCH LOWER ENERGY IS MORE REALISTIC. ANALYSES AND SCALE MODEL TESTS SHOW THAT THE DESIGN CAN CONTAIN THE ENERGY AT 150 MW-SEC AND MAINTAIN MECHANICAL INTEGRITY, NOT ONLY OF THE CONTAINMENT STRUCTURE BUT ALSO OF THE REACTOR VESSEL AND THE HEAT TRANSPORT SYSTEM.

14-5-5-482 MANAGEMENT OF RADIOACTIVE AQUEOUS WASTES FROM ALC FUEL REPROCESSING OPERATIONS
LENNEMANN, W. L.
U. S. ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.
SINCE 1944 THE U. S. ATOMIC ENERGY COMMISSION (AND ITS PREDECESSOR, THE MANHATTAN DISTRICT) HAS BEEN OVERSEEING THE MANAGEMENT OF RADIOACTIVE WASTES FROM ITS FUEL REPROCESSING PLANTS WHICH ARE CONTRACTOR OPERATED. EXPERIENCE DURING THE YEARS HAS INDICATED THAT MANAGEMENT OF THESE RADIOACTIVE WASTES REQUIRES UNRELENTING EVALUATION AND APPRAISAL BY HIGHER MANAGEMENT AND MANAGEMENT GROUPS. EXPERIENCE WITH LEAKING WASTE TANKS AT HANFORD, SAVANNAH RIVER, AND THE NATIONAL REACTOR TESTING STATION TO 1972 IS SUMMARIZED. IMPORTANT RELATED ACTIVITIES ARE PERIODIC REVIEWS, FREQUENT ANALYSES, AND CONTINUOUS PLANNING. GUIDANCE IS PROVIDED FOR DESIGNERS OF FUEL REPROCESSING WASTE MANAGEMENT SYSTEMS INCLUDING SUCH FEATURES AS ACID WASTE STORAGE, DOUBLE CONTAINMENT, PROTECTION AGAINST CREDIBLE FORCES OF NATURE, FACILITIES FOR EMPTYING WASTE STORAGE TANKS, SPACE AND ACCESSES FOR INSPECTION, ADEQUATE RADIATION MONITORING DEVICES CONNECTED TO A CENTRAL RECORDING STATION, AND SEGREGATION AND DIVERSION CAPABILITY FOR DISCHARGED EFFLUENT AQUEOUS STREAMS.

14-5-6-537 MATERIALS PERFORMANCE AT NUCLEAR POWER PLANTS
SCOTT, H. L., JR.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
SAFETY RELATED OCCURRENCES - FAILURES, INCIDENTS, AND DEFICIENCIES - REPORTED BY LIGHT WATER REACTOR NUCLEAR POWER PLANTS ARE REVIEWED FOR THE PERIOD 1967-1972. THE OCCURRENCES ARE LIMITED, HOWEVER, TO THOSE IN WHICH A MATERIAL FAILURE WAS INVOLVED. TABLES ARE GIVEN FOR EACH YEAR, INDICATING THE FACILITY AND COMPONENTS INVOLVED, THE CAUSE OF FAILURE, AND THE AREA IN WHICH THE DEFICIENCY ORIGINATED (I.E., MATERIAL SELECTION, DESIGN, FABRICATION, INSTALLATION, OPERATION, OR MAINTENANCE). EACH INCIDENT IS DISCUSSED, AND AREAS IN WHICH MATERIALS PERFORMANCE CAN BE IMPROVED ARE INDICATED.

14-6-1-563 NUCLEAR EMERGENCY PLANNING IN THE STATE OF NEW JERSEY
AMATO, C. G.
STATE OF NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, TRENTON, N. J.
TO MEET THE NECESSITY FOR A PUBLIC EMERGENCY PLAN FOR LARGE SCALE RADIATION INCIDENTS, THE STATE GOVERNMENT OF NEW JERSEY HAS DEVELOPED PIPAG. PROCEDURES FOR IMPLEMENTING PROTECTIVE ACTION GUIDES. PIPAG IS A CONTINGENCY PLAN BASED ON COOPERATIVE, PRUDENT PREPLANNING AIMED TOWARD MAINTAINING PUBLIC CONFIDENCE AND CONTROLLING DOSE AND DOSE COMMITMENTS. THE PLAN IS BASED ON THE LAW, GEOGRAPHY, RESOURCES, AND

POLICIES OF NEW JERSEY. IT MAXIMIZES THE USE OF EXISTING RESOURCES AND RELIES ON THE CONCEPT OF CIVIL DEFENSE ORGANIZATIONS AS LOCAL GOVERNMENTS IN AN EMERGENCY. BOTH THE TECHNOLOGY AND SOCIOLOGY ASPECTS OF A REACTOR ACCIDENT ARE CONSIDERED SINCE PIPAG, IF EVER IMPLEMENTED, WILL DEAL WITH COMMUNITIES OF PEOPLE. THE SOCIAL CONCEPTS OF DISASTER AND REACTOR ACCIDENTS ARE INTRODUCED, AND THE FACTORS AFFECTING DISASTERS, AS WELL AS PROTECTIVE ACTION LEVELS, ARE DISCUSSED.

14-5-1-574 STATE RESPONSIBILITIES FOR NUCLEAR POWER - LAPP REPORT TO THE ILLINOIS COMMERCE COMMISSION
NUCLEAR SAFETY EDITORIAL STAFF AT OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
FOLLOWING THE RELATED PUBLIC AND STATE AWARENESS OF TWO INCIDENTS THAT OCCURRED AT THE DRESDEN NUCLEAR POWER STATION IN 1970 AND 1971, THE STATE OF ILLINOIS UNDERTOOK A SEPARATE INVESTIGATION TO ASSURE THAT THE PUBLIC HEALTH AND SAFETY OF THE PEOPLE OF ILLINOIS ARE ADEQUATELY SAFEGUARDED. THIS INVESTIGATION WAS CONDUCTED IN PART BY DR. RALPH LAPP, A PRIVATE NUCLEAR CONSULTANT. HIS REPORT, SUBMITTED TO THE ILLINOIS COMMERCE COMMISSION ON DEC. 7, 1972, EXAMINES THE INCIDENTS AND SUBSEQUENT REVIEWS IN DETAIL AND MAKES CONCLUSIONS AND RECOMMENDATIONS RELEVANT TO A STATES RESPONSIBILITY TO ITS PUBLIC. TO THE EXTENT THAT THIS INFORMATION WOULD BE PERTINENT TO THE INTERACTION WHICH MAY BE EXPECTED BETWEEN ANY UTILITY AND ITS STATE GOVERNMENT, THE RELEVANT CONCLUSIONS ARE PRESENTED AS TAKEN FROM THE LAPP REPORT.

14-6-1-576 SITING PRACTICE AND ITS RELATION TO POPULATION
PIPER, H. B. + MIDDLETON, F. A.
PROJECT MANAGEMENT CORPORATION, CHICAGO, ILL. AND OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A STUDY WAS MADE TO DETERMINE THE RELATION BETWEEN POWER REACTOR SITES AND THE SURROUNDING POPULATION IN THE UNITED STATES AND IN SOME FOREIGN COUNTRIES. RESULTS SHOW THAT THE POPULATION VS. DISTANCE ENVELOPE REPRESENTED BY A COMBINATION OF THE INDIAN POINT AND ZION SITES HAS SERVED AS AN UPPER BOUNDARY IN CURRENT SITING PRACTICE. IT IS ALSO SHOWN THAT THE APPLICATION OF ENGINEERED SAFETY FEATURES HAS HAD NO DISCERNIBLE EFFECT ON THE SELECTION OF SITES.

14-6-2-586 POWER PLANT SAFETY AND EARTHQUAKES
SMITH, C. B.
APPLIED NUCLEONICS COMPANY, LOS ANGELES, CALIF.
THIS ARTICLE STRESSES THE IMPORTANCE OF CONSIDERING SEISMIC EFFECTS IN THE DESIGN OF POWER PLANTS FOR ELECTRICITY GENERATION, WITH EMPHASIS ON NUCLEAR POWER PLANTS. THE POTENTIAL EFFECTS ON PLANT PERFORMANCE ARE DESCRIBED, METHODS FOR SEISMIC ANALYSIS ARE REVIEWED, AND THE NEED FOR SEISMIC INSTRUMENTATION AND TESTING ARE DISCUSSED.

14-6-2-597 PROBABILITY AND CONSEQUENCES OF TRANSPORTATION ACCIDENTS INVOLVING RADIOACTIVE MATERIAL SHIPMENTS IN THE NUCLEAR FUEL CYCLE
SHAPPERT, L. B. + BROBST, W. A. + LANGHAAR, J. W.
SISLER, J. A.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN. + U. S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C. + E. I. DU PONT DE NEMOURS AND COMPANY, WILMINGTON, DEL. + U. S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
FOR 1980 THE PROJECTED ELECTRICAL GENERATING CAPACITY OF NUCLEAR POWER PLANTS IN THE UNITED STATES IS ABOUT 130 MW(E). THIS, IN TURN, WILL GENERATE THOUSANDS OF SHIPMENTS OF RADIOACTIVE MATERIALS ANNUALLY. THE PROBABILITY OF ACCIDENTS INVOLVING THESE SHIPMENTS WITHIN THE PUBLIC DOMAIN HAS BEEN ESTIMATED AND BROKEN DOWN INTO FIVE SEVERITY CATEGORIES. IT IS ESTIMATED THAT IN 1980 THE SHIPMENTS CONSIDERED WOULD BE INVOLVED IN LESS THAN 20 ACCIDENTS, MOST OF WHICH WOULD RESULT IN ONLY MODERATE DAMAGE TO THE SHIPPING SYSTEM AND NO SIGNIFICANT NUCLEAR RELATED HAZARDS. AN ESTIMATE WAS MADE OF THE EFFECT OF AN EXTREMELY SEVERE ACCIDENT INVOLVING LOSS OF CONTAMINATED COOLANT FROM A SPENT FUEL SHIPPING CASK AND THE POSSIBLE EXPOSURE TO THE PUBLIC. AS A RESULT OF THE ESTIMATES, IT IS CONCLUDED THAT THE LIKELIHOOD OF ANY SERIOUS RADIOLOGICAL INJURY IS VERY SMALL AND THE TRANSPORTATION OF NUCLEAR MATERIALS IN THE FUEL CYCLE HAS A HIGH DEGREE OF SAFETY.

14-6-3-605 COMPARATIVE RELIABILITY ANALYSES OF REACTOR SAFETY SYSTEMS
HOWARD, R. S. + SCHULTZ, M. A.
PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK, PENN.
FIVE REACTOR PROTECTION SYSTEMS HAVE BEEN ANALYZED USING A MONTE CARLO SIMULATION TECHNIQUE TO SOLVE FOR SYSTEM RELIABILITY AS A FUNCTION OF TEST AND REPAIR INTERVAL. THE SYSTEMS WERE EVALUATED FOR BOTH SAFETY RELIABILITY AND PROTECTION AGAINST FALSE SCRAMS. THE ANALYSIS TECHNIQUE IS DESCRIBED IN DETAIL, WITH EMPHASIS ON THE ASSUMPTIONS MADE AND THE VALIDITY OF THE RESULTS. A METHOD OF SCALING THE INPUT FOR THE MONTE CARLO PROGRAM BY VARYING THE REPAIR INTERVAL IS DEVELOPED. THE SYSTEMS ANALYZED INCLUDE FOUR COMMERCIAL REACTOR PROTECTION SYSTEMS, EACH DESIGNED BY A DIFFERENT MANUFACTURER, AND A PROPOSED SYSTEM, SUGGESTED AT PENNSYLVANIA STATE UNIVERSITY. THE RELIABILITIES OF THE SYSTEMS ARE COMPARED BY EXAMINING SYSTEM FAILURE PROBABILITIES. CONSIDERABLE

DIFFERENCES IN PERFORMANCE WERE FOUND IN THE VARIOUS SYSTEMS, SUGGESTING THAT STILL BETTER CONFIGURATIONS MAY YET BE OBTAINED.

14-6-4-618 SAFETY DESIGN BASES OF THE HTGR
WESSMAN, G. L. + MOFFETTE, T. R.
GULF GENERAL ATOMIC COMPANY, SAN DIEGO, CALIF.
THE HIGH TEMPERATURE GAS-COOLED REACTOR (HTGR) HAS INHERENT AND DESIGN SAFETY FEATURES THAT ARE SIGNIFICANT AND UNIQUE, REQUIRING A NUMBER OF SAFETY CRITERIA AND APPROACHES THAT DIFFER MARKEDLY FROM OTHER REACTOR TYPES. FIRST, THIS ARTICLE BRIEFLY REVIEWS THE DESIGN OF HTGR PLANTS THAT HAVE BEEN BUILT AND ARE BEING OFFERED IN THE UNITED STATES. IT THEN REVIEWS THE SAFETY CONSIDERATIONS IN THE DESIGN OF THE PLANTS NOW BEING OFFERED. THE UNIQUE FEATURES, THEIR DEVELOPMENT, AND THEIR EFFECTS ON SAFETY CRITERIA ARE DESCRIBED, WITH PARTICULAR EMPHASIS ON THE DESIGN BASES OF THE PRESTRESSED CONCRETE REACTOR VESSEL.

14-6-4-634 SIZING OF AIR CLEANING SYSTEMS FOR ACCESS TO NUCLEAR PLANT SPACES
ESTREICH, P. J.
EBASCO SERVICES INCORPORATED, NEW YORK, N. Y.
A MATHEMATICAL BASIS IS DEVELOPED TO PROVIDE THE PRACTICING ENGINEER WITH A METHOD FOR SIZING AIR CLEANING SYSTEMS FOR NUCLEAR FACILITIES. IN PARTICULAR, GENERAL FORMULAS ARE PROVIDED TO RELATE CLEANING AND CONTAMINATION DYNAMICS OF AN ENCLOSURE SUCH THAT SAFE CONDITIONS ARE OBTAINED WHEN WORKING CREWS ENTER. INCLUDED IN THESE CONSIDERATIONS IS THE SIZING OF AN AIR CLEANING SYSTEM TO PROVIDE RAPID DECONTAMINATION OF AIRBORNE RADIOACTIVITY. MULTIPLE NUCLIDE CONTAMINATION SOURCES, LEAK RATE, DIRECT RADIATION, CONTAMINANT MIXING EFFICIENCY, FILTER EFFICIENCIES, AIR CLEANING SYSTEM OPERATIONAL MODES, AND CRITERIA FOR MAXIMUM PERMISSIBLE CONCENTRATIONS ARE INTEGRATED INTO THE PROCEDURE.

14-6-5-643 PROBLEMS AND TECHNIQUES FOR REMOVAL OF RADON AND RADON DAUGHTER PRODUCTS FROM MINE ATMOSPHERES
GOODWIN, A.
U.S. DEPARTMENT OF THE INTERIOR, WASHINGTON, D.C.
VENTILATION WITH FRESH AIR HAS BEEN, AND WILL CONTINUE TO BE, THE PRIMARY SOLUTION FOR CONTROLLING RADON AND RADON DAUGHTER ACTIVITY IN MINES. HOWEVER, PROCEDURES TO MAKE THE VENTILATION PROCESS MORE EFFECTIVE AND TO REDUCE CONTAMINATION HAVE BEEN PROPOSED, SUCH AS SEALING OFF OF OLD WORKINGS, THE USE OF COATINGS TO REDUCE RADON INFLOW, AND MINE PRESSURIZATION. AIR CLEANING TECHNIQUES HAVE PROVED SUCCESSFUL IN CERTAIN APPLICATIONS. FOR EXAMPLE, RADON DAUGHTERS CAN BE REMOVED BY MECHANICAL FILTERING AND BY ELECTROSTATIC PRECIPITATION METHODS, BOTH OF WHICH REMOVE CONDENSATION NUCLEI TO WHICH RADON DAUGHTERS BECOME ATTACHED. THE RADON GAS THAT PASSES THROUGH CONTINUES TO DECAY, BUT, IN THE ABSENCE OF CONDENSATION NUCLEI, THE DAUGHTERS HAVE LARGE DIFFUSION LENGTHS AND ARE TRAPPED ON THE WALLS OF AIR COURSES, THUS INHIBITING THEIR GROWTH. RADON GAS HAS BEEN SUCCESSFULLY REMOVED FROM AIR, ALTHOUGH THERE ARE NO KNOWN REPORTS OF THIS HAVING BEEN DONE IN OPERATING MINES. IT HAS BEEN CAPTURED ON ACTIVATED CHARCOAL AND SILICA GEL AND CHEMICALLY REMOVED BY REACTING WITH A HALOGEN FLUORIDE AND A METAL FLUORIDE.

14-6-5-651 THE ORIGIN AND FINDINGS OF THE ATOMIC BOMB CASUALTY COMMISSION
JABLON, S.
NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D.C.
THE ATOMIC BOMB CASUALTY COMMISSION (ABCC) WAS AUTHORIZED IN NOVEMBER 1947, WHEN IT BECAME APPARENT TO THE EARLIER INVESTIGATION TEAM THAT LONG TERM STUDIES OF THE SURVIVORS WERE REQUIRED. THE ABCC WAS ESTABLISHED UNDER THE NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMY OF SCIENCES AND HAS SINCE, IN COOPERATION WITH THE JAPANESE INSTITUTE OF HEALTH, MAINTAINED A MEDICAL SURVEILLANCE OF MORE THAN 100,000 INDIVIDUALS. THE EXAMINATIONS REVEALED NO SIGNIFICANT CHANGE IN GENETIC EFFECTS, ALTHOUGH EFFECTS ON GROWTH, MENTAL RETARDATION, AND LENTICULAR OPACITIES WERE OBSERVED. THE MAJOR EFFORT OF THE STUDY HAS BEEN CONCERNED WITH MORTALITY STUDIES, WHEREIN THE RADIATION EFFECTS ARE MANIFESTED CHIEFLY THROUGH CHANGES IN THE OCCURRENCE OF CANCER. THE INCIDENCE OF LEUKEMIA AS A FUNCTION OF DOSE, AGE, AND TIME HAS BEEN OBTAINED. FOR SURVIVORS WHO HAD THE LARGEST DOSE, OVER 200 RADS, CANCER DEATHS HAVE BEEN ABOUT 60 PERCENT HIGHER THAN EXPECTATION. NO NOTICEABLE DIFFERENCE IN DEATH RATES WAS OBSERVED FOR ANY CAUSE EXCEPT CANCER. THE STUDIES ARE CONTINUING, AS THEY SHOULD, AT LEAST THROUGHOUT THE LIFETIME OF THE EXPOSED SURVIVORS.

14-6-6-660 SWITCH FAILURES AT NUCLEAR FACILITIES
CULBERT, W. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
SWITCH FAILURES IN NUCLEAR POWER PLANTS ARE REVIEWED FOR THE PERIOD 1964 TO MARCH 1973. THE TYPES OF FAILURES, SYSTEMS AFFECTED, AND THE NUMBER OF FAILURES ARE TABULATED, AND TECHNIQUES FOR MINIMIZING FAILURES ARE DISCUSSED.

15-1-1-031 REGULATION OF NUCLEAR POWER REACTORS AND RELATED FACILITIES
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE U.S. ATOMIC ENERGY COMMISSION (AEC) HAS THE RESPONSIBILITY TO PROTECT THE HEALTH AND SAFETY OF THE PUBLIC BY ASSURING THAT AN OWNER/OPERATOR DESIGNS, BUILDS, AND OPERATES, AND MAINTAINS THE INTEGRITY OF, A NUCLEAR FACILITY OVER ITS LIFETIME IN ACCORDANCE WITH THE CRITERIA, CODES, STANDARDS, AND REGULATORY JUDGMENTS DIRECTED TOWARD THAT END. THIS ARTICLE DISCUSSES THE PHILOSOPHY AND MEANS FOR PROTECTING THE PUBLIC HEALTH. THE RELEVANT AEC RULES AND REGULATIONS, AS WELL AS THE DETAILS OF THE LICENSING PROCESS AND THE AEC INSPECTION PROGRAM, ARE SUMMARIZED.

15-1-3-015 IAEA INTERNATIONAL SYMPOSIUMS ON NUCLEAR POWER PLANT CONTROL AND INSTRUMENTATION
HAGEN, E. W. + KERLIN, T. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
IN RECOGNITION OF THE SIGNIFICANT ADVANCES BEING MADE IN THE FIELD OF NUCLEAR POWER PLANT CONTROL AND INSTRUMENTATION, THE INTERNATIONAL ATOMIC ENERGY AGENCY ORGANIZED A SERIES OF BIANNUAL SYMPOSIUMS ON THE SUBJECT. THESE MEETINGS PROVIDED SPECIALISTS FROM THE MEMBER STATES WITH AN OPPORTUNITY FOR A COMPREHENSIVE EXCHANGE OF INFORMATION ON THE CURRENT INTERNATIONAL STATUS OF THIS IMPORTANT FIELD. IN THIS ARTICLE THE DISCOURSE FROM THE FIRST MEETING (VIENNA, 1969) IS SUMMARIZED. THE PROCEEDINGS FROM THE SECOND MEETING (VIENNA, 1971) ARE REVIEWED, AND SOME OF THE PRESENTATIONS MADE AT THE THIRD MEETING (PRAGUE, 1973) ARE DISCUSSED.

15-1-4-030 THE ECCS RULE-MAKING HEARING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE GENESIS, EXPOSITION, AND SOME OF THE RAMIFICATIONS OF THE ECCS RULE-MAKING HEARING, DOCKET RM-50-1, ARE REVIEWED. WHEN THE AEC PROMULGATED THE INTERIM ACCEPTANCE CRITERIA (IAC) IN JUNE OF 1971, A SERIES OF EVENTS WAS INITIATED WHICH IS STILL BEING FELT BY THE NUCLEAR COMMUNITY. THIS ARTICLE EXAMINES BRIEFLY WHAT THE EMERGENCY CORE COOLING SYSTEM (ECCS) IS AND HOW IT PERFORMS IN BOTH PWRS AND BWRS, AS WELL AS THE RESULTS OF THE VARIOUS STUDIES AND RESEARCH AND DEVELOPMENT (R+D) PROGRAMS THAT WERE EXTANT AT THAT TIME. THE RESULTING CONTROVERSIES FOLLOWING PUBLICATION OF THE IAC PRECIPITATED THE HEARING, WHICH BEGAN JAN. 27, 1972, AND ENDED JULY 25, 1973. THE COURSE OF THE HEARING AND THE AEC CONCLUDING STATEMENT - IN EFFECT, PROPOSED REVISED CRITERIA - ARE SUMMARIZED. ALTHOUGH THE PROPOSED CRITERIA HAVE NOT YET BEEN ADOPTED, THE RAMIFICATIONS OF THE HEARING INCLUDE A REVIEW AND REDIRECTION OF R+D PROGRAMS, CONTEMPLATED DERATING OF SOME EXISTING PLANTS, AND NEW REACTOR DESIGNS BY THE VENDORS. THE AUTHOR CONCLUDES THAT THE HEARING WAS A NECESSARY AND CONSTRUCTIVE, IF TRAUMATIC, EXPERIENCE.

15-1-5-056 POPULATION DOSES FROM THE NUCLEAR INDUSTRY TO 2000 A.D.
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
DURING THE NEXT FEW DECADES, IT IS ANTICIPATED THAT THE NUCLEAR POWER INDUSTRY IN THE UNITED STATES WILL UNDERGO A REMARKABLE GROWTH. TO PROJECT THE EFFECT OF THIS GROWTH ON THE RADIATION DOSES OF THE GENERAL PUBLIC, THE U.S. ATOMIC ENERGY COMMISSION MADE A REVIEW OF CURRENT REACTOR OPERATING EXPERIENCES. FROM THIS REVIEW A DETAILED ANALYSIS OF THE RADIATION DOSE TO A MAJOR SECTION OF THE COUNTRY DUE TO EFFLUENTS FROM NUCLEAR FACILITIES FOR CONDITIONS PROJECTED FOR THE YEAR 2000 WAS UNDERTAKEN. THE STUDY INDICATES THAT THE AVERAGE DOSE TO THE U.S. POPULATION FROM NUCLEAR POWER WILL INCREASE FROM AN ESTIMATED 0.003 MREM PER PERSON IN 1970 TO AS MUCH AS 0.2 MREM IN THE YEAR 2000. THIS CONTRIBUTION REMAINS A SMALL FRACTION OF THE RADIATION DOSE FROM EITHER NATURAL OR MAN-MADE SOURCES OF IONIZING RADIATION.

15-1-6-067 SAFETY RELATED OCCURRENCES IN NUCLEAR REACTOR POWER PLANTS IN 1972
SCOTT, R. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
SUMMARIZED AND EVALUATED ARE 644 REPORTS OF INCIDENTS, FAILURES, AND DESIGN OR CONSTRUCTION DEFICIENCIES AT LIGHT WATER REACTOR CENTRAL POWER STATIONS DURING 1972. THE MATERIAL IS PRESENTED IN TABLES THAT INCLUDE THE FREQUENCY OF ITEMS REPORTED WITH REGARD TO COMPONENTS, SYSTEMS, CAUSES, SPECIFIC DEFICIENCIES, AND TIME OF OCCURRENCE. SELECTED FOR DISCUSSION ARE INCIDENTS THAT OCCURRED DURING CONSTRUCTION AND OCCURRENCES AT BOILING WATER AND PRESSURIZED WATER REACTORS.

15-1-6-076 EVALUATION OF INCIDENTS OF PRIMARY COOLANT RELEASE FROM OPERATING BOILING WATER REACTORS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE REPORT EVOLVING FROM A REVIEW OF EIGHT INCIDENTS OF PRIMARY COOLANT RELEASES FROM EIGHT OPERATING BOILING WATER REACTORS BY A SEVEN MEMBER GROUP FROM THE AEC DIRECTORATE OF LICENSING AND DIRECTORATE OF REGULATORY OPERATIONS IS DESCRIBED. INCLUDED ARE SOURCES FOR OBTAINING THE REPORT AND THE COMPLETE SECTION ON CONCLUSIONS AND RECOMMENDATIONS.

15-2-1-127 AECS NUCLEAR SAFETY RESEARCH OBJECTIVES, PLANS, AND SCHEDULES
KOUTS, H. J. C.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
THE RESEARCH OBJECTIVES AND PROGRAM PLANS OF THE AECS RECENTLY ESTABLISHED DIVISION OF REACTOR SAFETY RESEARCH ARE DISCUSSED. THE PRIMARY OBJECTIVE OF THE DIVISION IS TO PROVIDE INFORMATION NEEDED BY THE ACRS AND THE REGULATORY STAFF SO AS TO AVOID UNNECESSARILY STRICT LIMITATIONS ON THE OPERATION OF NUCLEAR POWER PLANTS. THE MEANS FOR SATISFYING PUBLIC CONCERN RELATED TO THE SAFETY OF NUCLEAR PLANTS AND THE CONSERVATISM IMPOSED BY LACK OF KNOWLEDGE, AS BEING DEVELOPED BY THE SAFETY PROGRAM, ARE DISCUSSED. THE SAFETY PROJECTS CURRENTLY SPONSORED ARE ALL RELATED TO WATER REACTOR SAFETY, ALTHOUGH SAFETY STUDIES RELATING TO THE HTGR AND THE LMFBR ARE PLANNED. IN ADDITION TO THE LOFT AND THE PBF - TWO LARGE PROGRAMS WHICH HAVE BEEN UNDER WAY FOR SOME TIME - A NUMBER OF SMALLER, MORE BASIC PROJECTS ARE ALSO UNDER WAY IN THE AREAS OF BLOWDOWN HEAT TRANSFER, TWO-PHASE PUMP CHARACTERISTICS, STEAM WATER MIXING, AND PRIMARY SYSTEM INTEGRITY. SEVERAL ADDITIONAL WATER REACTOR SAFETY PROJECTS, SOME BEING INITIATED AND OTHERS BEING PLANNED, ARE IDENTIFIED AND DISCUSSED.

15-2-1-132 AEC TESTIMONY AT THE 1973 JCAE HEARINGS ON REACTOR SAFETY
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
IN PHASE IIA OF THE JOINT COMMITTEE ON ATOMIC ENERGYS HEARINGS ON REACTOR SAFETY, HELD SEPT. 25-27 AND OCT. 1, 1973, THE 5 AEC COMMISSIONERS AND 12 OF THEIR STAFF PRESENTED TESTIMONY. THIS TESTIMONY, WHICH IS REVIEWED HERE AS REPORTED IN THE HEARING RECORD, WAS CONCERNED WITH ALL ASPECTS OF COMMISSION ACTIVITIES RELATED TO THE NUCLEAR POWER-REACTOR PROGRAM, INCLUDING (1) REACTOR SAFETY RESEARCH AND DEVELOPMENT, (2) WASTE-MANAGEMENT INVESTIGATIONS, (3) THE PROTECTION OF MATERIALS AND FACILITIES, AND (4) THE AECS REGULATORY ACTIVITIES AS WELL AS THOSE OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS AND THE ATOMIC SAFETY AND LICENSING BOARD PANEL. THE PRESENTATIONS AS A WHOLE REFLECT TREMENDOUS ACTIVITY ON THE PART OF THE AEC TO PROVIDE FOR THE SAFE UTILIZATION OF THIS ENERGY RESOURCE. THE PRESENTATION DISCUSSED IN DETAIL MANY ACTUAL AND POTENTIAL PROBLEMS, INCLUDING NEEDED SAFETY RESEARCH, THE ACCIDENT RISK STUDY, WASTE MANAGEMENT EXPERIENCE, SABOTAGE, DIVERSION, REACTOR LICENSING, INSPECTION, OPERATING EXPERIENCE, AND STANDARDS DEVELOPMENT.

15-2-2-146 IAEA-IWGFR MEETING ON SODIUM COMBUSTION AND ITS EXTINGUISHMENT
HILLIARD, R. K.
HANFORD ENGINEERING DEVELOPMENT LABORATORY, RICHLAND, WASH.
SPECIALISTS FROM SIX NATIONS PARTICIPATED IN A WORKING-GROUP MEETING ON THE TECHNIQUES AND TECHNOLOGY OF SODIUM COMBUSTION AND ITS EXTINGUISHMENT. THE MEETING WAS HELD IN RICHLAND, WASH., ON MAY 22-25, 1972. THE PRINCIPAL TOPICS CONSIDERED WERE DETECTION OF SODIUM LEAKS AND FIRES, EXTINGUISHMENT OF SODIUM FIRES, AND CONTROL OF COMBUSTION PRODUCTS. ALTHOUGH MUCH INFORMATION ON THESE TOPICS IS NOW AVAILABLE, THE LMFBR INDUSTRY WILL REQUIRE ADDITIONAL DEVELOPMENT IN ALL AREAS.

15-2-3-151 ANTICIPATED TRANSIENTS WITHOUT SCRAM FOR WATER COOLED POWER REACTORS
AEC REGULATORY STAFF
AEC
THE ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS) REPORT FOR WATER COOLED NUCLEAR POWER PLANTS PROVIDES A GENERAL EXPLANATION OF THE POSSIBILITY OF OCCURRENCE OF AN ATWS EVENT AND OF THE NATURE OF THE RESULTANT CONSEQUENCES. THE RELIABILITY REQUIRED OF THE PROTECTION OR SHUTDOWN SYSTEM TO REDUCE THE ATWS TO AN ACCEPTABLE RISK IS DETERMINED, AND DESIGN ASPECTS AND FAILURE ANALYSES OF THE PROTECTION SYSTEM ARE DISCUSSED. THE REGULATORY STAFFS CONCLUSIONS ARE GIVEN, AND, WITH THE OBJECTIVE OF IMPROVING REACTOR PLANT SAFETY AND PROTECTION SYSTEM RELIABILITY, AN IMPLEMENTATION PROGRAM INCLUDING BACKFITTING IS PRESENTED.

15-2-3-154 SAFETY ASSESSMENT OF REACTOR SYSTEMS
GREEN, A. E.
UNITED KINGDOM ATOMIC ENERGY AUTHORITY, RISLEY, WARRINGTON, LANCASHIRE, ENGLAND
THE PRACTICE IN THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY IS TO CARRY OUT INDEPENDENT RELIABILITY AND SAFETY ASSESSMENTS OF THOSE REACTOR SYSTEMS ON WHICH SAFETY IS DEPENDENT. THE INDEPENDENT ASSESSMENT IS COMPLEMENTARY TO THE DESIGN PROCESS, AND, WHEN THE RESULTS ARE IN AGREEMENT, GREATER CONFIDENCE IS PLACED IN PROCEEDING WITH THE DEVELOPMENT OF THE SYSTEM OR PROJECT. PRESENTED ARE VIEWPOINTS IN THE UNITED KINGDOM ON HOW SAFETY OF SYSTEMS SHOULD BE PREDICTED, EMPLOYING COMPONENT FAILURE PROBABILITIES INTERPRETED IN THE LIGHT OF 'REAL-WORLD' CONSIDERATIONS. THE TYPE OF SAFETY ASSESSMENT DESCRIBED HAS BEEN SUCCESSFUL IN A NUMBER OF APPLICATIONS, AND THESE BENEFITS ARE REVIEWED.

15-2-4-163 EVOLUTION AND CURRENT STATUS OF THE MARK CONTAINMENT SYSTEM
MADE, G. E.
GENERAL ELECTRIC COMPANY, SAN JOSE, CALIF.
THE CONTAINMENT SYSTEM FOR BOILING-WATER REACTORS HAS EVOLVED FROM THE DRY SPHERICAL TYPE USED ON DRESDEN 1 THROUGH FOUR GENERATIONS OF PRESSURE SUPPRESSION TYPES. THE MARK I, II, AND III PRESSURE SUPPRESSION CONTAINMENT SIZES AND ARRANGEMENTS ARE PRESENTED, AND THE REASONS FOR THE DESIGN EVOLUTION ARE DISCUSSED. THE FIVE BASIC MODULES IN THE PRESSURE SUPPRESSION ANALYTICAL MODEL AND A TYPICAL RESPONSE TO A LOSS OF COOLANT ACCIDENT ARE DESCRIBED. THE TEST PROGRAM BEING CONDUCTED TO VERIFY THE NEW PRESSURE SUPPRESSION HORIZONTAL VENT DESIGN IS BRIEFLY DESCRIBED. OVERALL DESIGN CHARACTERISTICS OF THE EMERGENCY CORE COOLING SYSTEM NETWORK, WHICH IS ESSENTIAL IN MAINTAINING THE INTEGRITY OF THE CONTAINMENT, ARE OUTLINED. THE NEW MARK III CONTAINMENT DESIGN ELIMINATES THE NEED FOR INERTING. THE DESIGN OBJECTIVES ARE OUTLINED FOR THE SYSTEM THAT HANDLES THE HYDROGEN GENERATED BY THE INITIAL METAL WATER REACTION OF THE ZIRCONIUM.

15-2-4-173 NEW ACCEPTANCE CRITERIA FOR EMERGENCY CORE COOLING SYSTEMS OF LIGHT WATER COOLED NUCLEAR POWER REACTORS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
IN A 140-PAGE REPORT ISSUED DEC. 28, 1973, THE ATOMIC ENERGY COMMISSION ESTABLISHED REVISED ECCS DESIGN CRITERIA, GAVE THE SCHEDULE FOR THEIR IMPLEMENTATION, AND PRESENTED A DETAILED TECHNICAL JUSTIFICATION FOR THE REVISIONS. BECAUSE OF THE INTEREST IN THIS MATTER, WE ARE PRESENTING HERE THE NEW CRITERIA AND THE INTRODUCTION TO THE AFOREMENTIONED REPORT WHICH SUMMARIZES THE COMMISSIONS POSITION. THESE SECTIONS ARE PRESENTED BELOW AS THEY APPEAR IN THE COMMISSION DOCUMENT EXCEPT THAT REFERENCED MATERIAL HAS BEEN EXPANDED AND PLACED AT THE END OF THE ARTICLE AND FOOTNOTES HAVE BEEN INCORPORATED INTO THE TEXT. THE LENGTH OF THE REPORT PRECLUDED PUBLICATION HERE OF THE DETAILED TECHNICAL RATIONALE, BUT THAT MAY BE FOUND IN THE DECEMBER 1973 ISSUE OF REGULATORY ADJUDICATION ISSUANCES (RAI-73-12), PAGES 1085-113d. THE ECCS RULE-MAKING HEARING, DOCKET RM-50-1, WHICH LED TO THIS COMMISSION REPORT, WAS SUMMARIZED IN NUCLEAR SAFETY, VOL. 15, NO. 1, PAGES 30-55.

15-2-5-185 RADIATION PROTECTION ACTIVITIES OF THE BUREAU OF RADIOLOGICAL HEALTH
DEVORE, R. T.
U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, WASHINGTON, D.C.
THE BUREAU OF RADIOLOGICAL HEALTH OF THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE HAS NUMEROUS RESPONSIBILITIES REGARDING THE LIMITATION OF MANS EXPOSURE TO IONIZING AND NONIONIZING RADIATIONS. THIS ARTICLE SUMMARIZES MANY OF THE BUREAUS ACTIVITIES IN 1972 IN DISCHARGING THESE RESPONSIBILITIES. INCLUDED HEREIN ARE BRIEF REPORTS ON THE BUREAUS WORK IN THE FOLLOWING AREAS. (1) STUDIES OF DIAGNOSTIC X-RAY EXPOSURES. (2) DEVELOPMENT OF X-RAY-MACHINE SAFETY STANDARD. (3) X-RAY-USER TRAINING AND EDUCATION. (4) DEVELOPMENT OF LASER AND INDUSTRIAL X-RAY STANDARDS. (5) DEVELOPMENT OF MICROWAVE-OVEN STANDARD. (6) ENFORCEMENT ACTIVITIES. (7) IMPROVED PROTECTION IN THE HANDLING OF RADIOACTIVE MATERIALS, AND (8) RESEARCH ON BIOLOGICAL EFFECTS.

15-2-5-190 FOG AND DRIFT DEPOSITION FROM EVAPORATIVE COOLING TOWERS
HANNA, S. R.
AIR RESOURCES ATMOSPHERIC TURBULENCE AND DIFFUSION LABORATORY, OAK RIDGE, TENN.
METHODS OF DETERMINING FOG AND DRIFT DEPOSITION DUE TO EMISSIONS FROM EVAPORATIVE COOLING TOWERS ARE REVIEWED AND FORMULAS SUGGESTED THAT CAN BE USED AS A BASIS FOR CALCULATIONS. THE GAUSSIAN PLUME FORMULA IS RECOMMENDED FOR CALCULATING FOG CONCENTRATIONS FROM WHICH VISIBILITY CAN BE ESTIMATED. FOR DRIFT DROPLETS WITH DIAMETERS GREATER THAN 200 MICROMETERS, DEPOSITION IS CALCULATED BY BALLISTICS METHODS, KNOWING THE ENVIRONMENTAL WIND SPEED AND RELATIVE HUMIDITY AND THE VERTICAL VELOCITY OF THE PLUME AND THE DROPLET. EVAPORATION OF THE DROPLETS IS ACCOUNTED FOR. DRIFT DROPLETS WITH DIAMETERS LESS THAN 200 MICROMETERS ARE ASSUMED TO BE DISPERSED ACCORDING TO THE GAUSSIAN PLUME FORMULA, WITH THE PLUME TILTED DOWNWARD TO ACCOUNT FOR THE SETTLING SPEED OF THE DROPLET.

15-2-6-198 SUMMARY OF RECENT ABNORMAL OCCURRENCES AT POWER REACTOR FACILITIES
THOMPSON, D.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
THE EDITORS OF NUCLEAR SAFETY HAD PREVIOUSLY BEEN EXTRACTING INFORMATION ON RECENT OCCURRENCES FROM THE MORE COMPREHENSIVE FILES OF THE NUCLEAR SAFETY INFORMATION CENTER. WE ARE PLEASED TO INITIATE IN THIS ISSUE A SUMMARY USING PRINTOUT FROM THE RECENTLY ESTABLISHED FILE ON ABNORMAL OCCURRENCE REPORTS WHICH HAS BEEN DEVELOPED BY THE OFFICE OF OPERATIONS EVALUATION, AEC DIRECTORATE OF REGULATORY OPERATIONS.

15-3-1-241 WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE IS A REVIEW OF THE WATER REACTOR SAFETY RESEARCH INFORMATION MEETING, SPONSORED BY THE AEC DIVISION OF REACTOR SAFETY RESEARCH, HELD AT AEC HEADQUARTERS, WASHINGTON, D.C., DEC.4-6,1973. OVER 150 PEOPLE ATTENDED THE MEETING, BUT NO PROCEEDINGS ARE PLANNED. THE MEETING INCLUDED 37 PRESENTATIONS GROUPED INTO THE FOLLOWING SESSIONS (I) SEPARATE-EFFECTS PROGRAM, (II) LOSS-OF-FLUID TEST (LOFT) PROGRAM, (III) POWER BURST FACILITY (PBF) PROGRAM, (IV) LOSS-OF-COOLANT (LOCA) ANALYSIS PROGRAMS, (V) REACTOR SAFETY STUDIES, (VI) REGULATORY TECHNICAL ASSISTANCE PROGRAMS, (VII) HEAVY SECTION STEEL TECHNOLOGY PROGRAM, (VIIIA) REACTOR PRIMARY COOLANT SYSTEM PIPE RUPTURE STUDIES, AND (VIIIB) VENDOR REACTOR SAFETY PROGRAMS. IT IS APPARENT FROM THESE PRESENTATIONS THAT THE AEC IS SPONSORING EXTENSIVE PROGRAMS IN THE AREAS OF BOTH LOCA AND PRIMARY SYSTEM INTEGRITY, BUT MUCH WORK REMAINS TO BE DONE. BRIEF SUMMARIES OF ALL PRESENTATIONS ARE INCLUDED.

15-3-1-262 THE NEW FEDERAL WATER POLLUTION CONTROL ACT AND ITS IMPACT ON NUCLEAR POWER PLANTS I. APPLICATION OF THE FWPCA AND RELATED LEGISLATION TO INDIVIDUAL DISCHARGERS THROUGH PERMIT PROGRAMS
DAVIS, J. P.
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
THIS TWO PART ARTICLE PRESENTS A GENERAL OVERVIEW OF THE NEW FEDERAL WATER POLLUTION CONTROL ACT (ENACTED IN OCTOBER 1972) AND DISCUSSES ITS IMPACT ON THE REGULATION OF NUCLEAR POWER FACILITIES. PART I, INCLUDED HERE, DESCRIBES THE PERMIT PROGRAM FOR THE NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM, WHICH REPLACES THE REFUSE ACT PERMIT PROGRAM AND REQUIRES A PERMIT FOR THE DISCHARGE OF ANY SUBSTANCE TO THE WATERWAYS OF THE UNITED STATES.

15-3-2-276 PROBABILISTIC ASSESSMENT OF AIRCRAFT RISK FOR NUCLEAR POWER PLANTS
WALL, I. B.
GENERAL ELECTRIC COMPANY, SAN JOSE, CALIF.
THE RISK TO THE PUBLIC FROM AN AIRCRAFT STRIKING A NUCLEAR POWER PLANT HAS BEEN EVALUATED IN A QUANTIFIED MANNER. AIRCRAFT ACCIDENT DATA HAVE BEEN ANALYZED TO ESTIMATE THE PROBABILITY OF AN AIRCRAFT STRIKING A TYPICAL NUCLEAR POWER PLANT AT SITES ADJACENT TO AND REMOTE FROM AN AIRPORT. IN THE EVENT THAT AN AIRCRAFT STRIKES A BUILDING, THE REGION OF IMPACT IS GENERALLY RESTRICTED TO A LOCAL COMPONENT. TWO MODES OF SIGNIFICANT DAMAGE ARE DELINEATED (1) PERFORATION AND (2) LOCAL COLLAPSE. METHODS HAVE BEEN DEVELOPED TO ESTIMATE THE CONDITIONAL PROBABILITIES OF SUCH STRUCTURAL DAMAGE GIVEN AN AIRCRAFT STRIKE AND PROBABILITY VALUES CALCULATED FOR A REPRESENTATIVE STRUCTURE. ACTUAL RISK TO THE PUBLIC (PROBABILITY VS. RADIOACTIVE-RELEASE MAGNITUDE) MAY BE ESTIMATED FROM A CLASSIFICATION OF CRITICAL SAFETY COMPONENTS BY THEIR STRUCTURAL PROTECTION AND THE LIKELY RELEASE MAGNITUDE IN THE EVENT OF THEIR DAMAGE. ALL FORESEEABLE RELEASES EITHER CAUSE INSIGNIFICANT OFF-SITE DOSE OR, FOR MOST SITES, ARE ASSOCIATED WITH VERY LOW PROBABILITIES. A BRIEF EVALUATION SHOWS THAT FIRE UPON IMPACT IS NOT A SIGNIFICANT INCREMENT OF RISK. COMPARISON OF THESE RISKS TO SOCIALLY ACCEPTABLE RISK LEVELS SHOWS THAT REACTOR SITES BEYOND 5 MILES FROM AN AIRPORT OR AWAY FROM A BUSY AIR CORRIDOR SHOULD BE ACCEPTABLE. OTHER POTENTIAL SITES NEED INDIVIDUAL EXAMINATION, AND, IN SOME CASES, HARDENING OF THE STRUCTURE MAY BE NECESSARY.

15-3-2-285 ANALYSIS OF A SUDDEN MAJOR LOSS OF COOLANT ACCOMPANIED BY SERIOUS FAILURE OF EMERGENCY CORE COOLING CASE, E. G.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.
IN AN ARTICLE DERIVED FROM TESTIMONY AT A RECENT PUBLIC HEARING ON AN OPERATING LICENSE FOR PRAIRIE ISLAND 1 AND 2, AEC TESTIMONY AS TO THE PROBABILITY OF A SPECIFIC CLASS 9 ACCIDENT-A SUDDEN LOSS-OF-COOLANT ACCIDENT (LOCA) ACCOMPANIED BY A SERIOUS FAILURE OF EMERGENCY CORE COOLING WAS PRESENTED. IN ARRIVING AT THE CONCLUSION THAT THE PROBABILITY FOR SUCH AN EVENT WOULD BE LESS THAN 10(EXP-7) PER REACTOR YEAR AND THAT THE ENVIRONMENTAL RISK OF SUCH AN ACCIDENT WAS NEGLIGIBLE, FAILURE PROBABILITIES WERE ASSIGNED TO THREE STEPS IN THE ACCIDENT SEQUENCE. THE LIKELIHOOD OF A SUDDEN MAJOR LOCA WAS IN THE RANGE 10(EXP-3)-(EXP-5) PER REACTOR YEAR, THE LIKELIHOOD OF SERIOUS EMERGENCY CORE COOLING SYSTEM FAILURE WAS IN THE RANGE 10(EXP-2)-(EXP-4) PER REACTOR YEAR, AND THE LIKELIHOOD OF CONTAINMENT BREACH WAS IN THE RANGE 10(EXP-3)-(EXP-4). THIS ARTICLE SUMMARIZES THE COMMISSIONS RATIONALE FOR ITS PROBABILITY ESTIMATES.

15-3-3-292 ANS STANDARD N18.8 ON DESIGN BASES FOR PROTECTIVE SYSTEMS
FERGUSON, R. L.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.
THE STANDARDS COMMITTEE OF THE AMERICAN NUCLEAR SOCIETY HAS DEVELOPED CRITERIA RELATED TO ESTABLISHING THE DESIGN BASES FOR THE INTEGRATED RESPONSE OF THE ACTUATOR SYSTEMS, THE PROTECTION SYSTEMS, AND THEIR SUPPORTING SYSTEMS TO THE POSTULATED ACCIDENTAL EVENTS THAT MIGHT OCCUR DURING THE LIFE OF NUCLEAR POWER STATIONS. THESE CRITERIA REPRESENT THE FIRST ATTEMPT TO DEVELOP CRITERIA FOR THE INTEGRATED RESPONSE OF THE SEVERAL SYSTEMS THAT PROTECT THE STATION AND THE PUBLIC.

15-3-4-295 THE SAFETY AND CONTROL OF URANIUM-235 SOLUTION IN TANKS CONTAINING A FIXED NEUTRON ABSORBER
ROTHE, R. E. + ALVEREZ, O. L.
DOW CHEMICAL COMPANY, ROCKY FLATS, COLO.
RASCHIG RINGS HAVE BEEN USED FOR CRITICALITY PREVENTION IN THE STORAGE OF ENRICHED URANIUM-235 SOLUTION FOR OVER 8 YEARS AT THE DOW CHEMICAL COMPANYS NUCLEAR SAFETY LABORATORY AT ROCKY FLATS, COLO. UNDER NEARLY IDEAL STORAGE CONDITIONS. THE RELATIVELY PURE, LOW ACID SOLUTION HAS CAUSED NO CORROSION. PRODUCTION PLANTS HANDLING INDUSTRIAL GRADE SOLUTIONS EXPERIENCE GREATER CORROSION, REQUIRING OCCASIONAL RING REPLACEMENT. MATERIAL ACCOUNTABILITY PROCEDURES ALLOW MASS BASED INVENTORY MEASUREMENTS TO 0.1 PERCENT. A NOVEL VOLUME CALIBRATION TECHNIQUE ENHANCES THE ACCURACY AND HEALTH PHYSICS SAFETY OF GOOD MATERIAL CONTROL, WHICH IN TURN CONTRIBUTES TO NUCLEAR SAFETY. THE MORE AN INDUSTRIAL LIQUID DIFFERS FROM THE PRESENT SOLUTION, THE LESS APPLICABLE ARE THE CONCLUSIONS REPORTED HERE.

15-3-4-302 SEPARATION AND CONTAINMENT OF NOBLE GASES (A REVIEW OF NINE PAPERS PRESENTED AT THE 1973 NOBLE GASES SYMPOSIUM AT LAS VEGAS)
BARTON, C. J.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE NOBLE GASES SYMPOSIUM HELD IN LAS VEGAS, NEV., SEPT.24-28,1973, COVERED ALL IMPORTANT ASPECTS OF THIS TOPIC, INCLUDING SEPARATION AND CONTAINMENT CONSIDERED HERE. CHARCOAL BEDS, AT AMBIENT OR LOWER TEMPERATURES, PROVIDE A WIDE RANGE OF DELAY TIMES TO PERMIT DECAY OF THE SHORT LIVED RARE GASES. MORE SOPHISTICATED TECHNIQUES, SUCH AS CRYOGENIC SYSTEMS AND ABSORPTION IN LIQUID FLUOROCARBONS, CAN MINIMIZE THE VOLUME OF LONG LIVED SEPARATED RARE GAS, PRINCIPALLY KRYPTON-85, FOR LONG TERM STORAGE. CONTAINMENT OF KRYPTON-85 IN PRESSURIZED STEEL CYLINDERS STORED IN WELL ENGINEERED FACILITIES IS THE PREFERRED METHOD AT PRESENT.

15-3-5-306 IAEA-WMO SYMPOSIUM ON THE PHYSICAL BEHAVIOR OF RADIOACTIVE CONTAMINANTS IN THE ATMOSPHERE
HOSKER, R. P., JR.
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION OAK RIDGE, TENN.
THIS ARTICLE IS A REVIEW OF A SYMPOSIUM ON THE BEHAVIOR OF RADIOACTIVE ATMOSPHERIC CONTAMINANTS. THE SYMPOSIUM WAS HELD IN VIENNA, NOV.12-16,1973. THECHETICAL AND EXPERIMENTAL REPORTS ON LOCAL, REGIONAL, AND GLOBAL DISPERSION OF EFFLUENTS ARE DISCUSSED, AS ARE THE PRODUCTION AND ENVIRONMENTAL IMPACT OF THE EFFLUENTS.

15-3-6-311 RELEASES OF RADIOACTIVITY IN EFFLUENTS AND SOLID WASTE FROM NUCLEAR POWER PLANTS IN 1972
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
PRESENTED IN THIS ARTICLE IS A TABULATION OF RADIOACTIVITY IN EFFLUENTS AND SOLID WASTE FROM NUCLEAR POWER PLANTS FOR CALENDAR YEAR 1972. THE DATA INCLUDED ARE THOSE REPORTED BY THE LICENSEE EXCEPT FOR CERTAIN CALCULATIONS MADE BY THE AEC REGULATORY STAFF. A SIMILAR REPORT WAS MADE FOR 1971. IT IS ALSO SHOWN IN THIS ARTICLE THAT THE RADIOACTIVITY IN EFFLUENTS FROM LICENSED NUCLEAR POWER PLANTS HAS GENERALLY BEEN LOW IN COMPARISON WITH THE LIMITS SET FORTH IN THE U.S. ATOMIC ENERGY COMMISSIONS 10 CFR, PART 20, STANDARDS FOR PROTECTION AGAINST RADIATION.

15-3-6-316 VALVE MALFUNCTIONS IN NUCLEAR POWER PLANTS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE PRESENTS THE RESULTS OF THREE INDEPENDENT SURVEYS OF DATA DESCRIBING MALFUNCTIONS OF VALVES USED IN REACTOR FACILITIES DURING THREE SEPARATE BUT OVERLAPPING TIME INTERVALS AND A FOURTH SURVEY OF EXPERIENCE CONCERNING THE STRUCTURAL INTEGRITY OF VALVES. NONE OF THE VALVE PROBLEMS COVERED BY THE REVIEWS HAVE POSED A THREAT TO THE HEALTH AND SAFETY OF THE OFF-SITE PUBLIC. HOWEVER, IN A FEW CASES, VALVE MALFUNCTIONS HAVE LED TO NONRADIOLOGICAL INJURIES TO PLANT PERSONNEL. THE APPARENT RATES OF MALFUNCTION OF VALVES RANGED FROM 2.5 TO 8.1 PER PLANT PER YEAR, ALTHOUGH THE HIGHER NUMBER IS BELIEVED BIASED BY A LARGE AMOUNT OF PREOPERATIONAL TEST DATA. THE FOURTH SURVEY INDICATED THAT 15 PERCENT OF THE VALVES DID NOT MEET WALL THICKNESS SPECIFICATIONS.

15-4-1-375 THE AEC STUDY ON THE ESTIMATION OF RISKS TO THE PUBLIC FROM POTENTIAL ACCIDENTS IN NUCLEAR POWER PLANTS
RASMUSSEN, N. C.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.
THE U.S. ATOMIC ENERGY COMMISSION INITIATED A REACTOR SAFETY STUDY IN SEPTEMBER 1972 TO ESTIMATE THE PROBABILITY OF OCCURRENCE OF VARIOUS POTENTIAL ACCIDENTS IN LIGHT WATER NUCLEAR POWER PLANTS AND OF THEIR CONSEQUENCES. THE STUDY IS DIVIDED INTO SEVEN MAJOR TASKS, INCLUDING SUCH TOPICS AS THE IDENTIFICATION OF ACCIDENT SEQUENCES, THE ASSIGNMENT OF PROBABILITIES, FISSION PRODUCT TRANSPORT IN EACH ACCIDENT SEQUENCE, FISSION PRODUCT DISTRIBUTION IN THE ENVIRONMENT, HEALTH EFFECTS AND PROPERTY DAMAGE, NONNUCLEAR RISKS, AND INTERPRETATION AND COMMUNICATION OF THE MEANING OF LOW PROBABILITY EVENTS TO NONTECHNICAL READERS. A FINAL REPORT IS EXPECTED IN THE SUMMER OF 1974.

15-4-1-383 THE ROLE OF THE ATOMIC SAFETY AND LICENSING BOARD PANEL
GOODRICH, N. H.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
(EDITORS NOTE - THIS ARTICLE WAS ADAPTED BY THE NUCLEAR SAFETY STAFF FROM THE TESTIMONY OF THE ATOMIC SAFETY AND LICENSING BOARD (ASLB) PANEL CHAIRMAN, NATHANIEL H. GOODRICH, BEFORE THE JOINT COMMITTEE ON ATOMIC ENERGY OF THE U.S. CONGRESS ON SEPT.27,1973. CHAIRMAN GOODRICH OUTLINES THE ASLB WORK LOAD AND EXPLAINS HOW BOARDS ARE APPOINTED. VARIOUS FACETS OF THE HEARING PROCESS ARE DISCUSSED, INCLUDING SPECIFICALLY THE LEGAL BASIS, CONDUCT, ASSETS AND CONTRIBUTIONS, AND OPTIMIZATION. SOME RECENT EXPERIENCES ARE ALSO MENTIONED.) THE FUNCTION OF THE ATOMIC SAFETY AND LICENSING BOARD (ASLB) IS TO CONDUCT HEARINGS, AS NEEDED, PURSUANT TO SEC. 191 OF THE ATOMIC ENERGY ACT. HEARINGS ARE CONDUCTED IN EACH INSTANCE BY THREE MEMBER BOARDS APPOINTED FROM THE MEMBERSHIP OF THE ASLB PANEL, WHICH WAS RECONSTITUTED FOR THIS SOLE PURPOSE IN NOVEMBER 1971. PRIOR TO THAT TIME, PANEL OFFICIALS ALSO WERE RESPONSIBLE FOR APPELLATE REVIEW OF HEARING BOARD DECISIONS. THE APPEAL FUNCTION IS NOW CONDUCTED SEPARATELY BY BOARDS APPOINTED FROM AN ATOMIC SAFETY AND LICENSING APPEAL PANEL, WHICH OPERATES INDEPENDENTLY OF THE ASLB PANEL.

15-4-2-387 PRESSURE VESSEL FAILURE STATISTICS AND FAILURE PROBABILITIES
ADVISORY COMMITTEE REACTOR SAFEGUARDS, U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
(EDITOR'S NOTE - THIS ARTICLE WAS ADAPTED FROM SECTION 5 OF 'REPORT ON THE INTEGRITY OF REACTOR VESSELS FOR LIGHT WATER POWER REACTORS,' WASH-1285, PUBLISHED BY THE AEC ADVISORY COMMITTEE ON REACTOR SAFEGUARDS IN JANUARY 1974. THE EDITORS FELT THAT THE STATISTICAL DATA ON PRESSURE VESSEL FAILURES PRESENTED HERE WOULD BE OF PARTICULAR INTEREST TO THE READERS OF NUCLEAR SAFETY. THOSE INTERESTED IN THE BACKGROUND AND SUPPORTING MATERIAL PRESENTED IN THE REMAINDER OF THE REPORT MAY OBTAIN A COMPLETE COPY FROM THE SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, FOR $1.20.) OPERATING EXPERIENCE WITH NUCLEAR REACTOR PRESSURE VESSELS IS INADEQUATE, BOTH WITH RESPECT TO THE NUMBER OF VESSEL YEARS OF SERVICE AND THE NUMBER OF KNOWN DEFECTS, TO PERMIT A DIRECT STATISTICAL DETERMINATION OF THE PROBABILITY OF FAILURE. THUS AN ALTERNATE APPROACH HAS BEEN TAKEN WHICH INVOLVES THE FOLLOWING STEPS: 1. CONSIDERATION OF OPERATIONAL AND FAILURE DATA FOR NONNUCLEAR TYPES OF PRESSURIZED COMPONENTS, SUCH AS BOILER DRUMS AND UNFIRED PRESSURE VESSELS. 2. CLASSIFICATION OF THESE NONNUCLEAR VESSEL FAILURES INTO THREE CATEGORIES ADOPTED FOR THIS ARTICLE. 3. COMPARISON OF THE DESIGN, CONSTRUCTION, INSPECTION, AND OPERATING PROCEDURES USED FOR BOILER DRUMS AND UNFIRED PRESSURE VESSELS WITH THOSE USED FOR NUCLEAR REACTOR VESSELS, AND ESTIMATION OF THE EFFECTS OF ANY DIFFERENCES ON THE RELATIVE PROBABILITY OF FAILURE OF THE TWO TYPES OF VESSELS. 4. UTILIZATION OF THE INFORMATION FROM THE ABOVE STEPS TO APPRAISE THE PROBABILITY OF DISRUPTIVE REACTOR VESSEL FAILURE.

15-4-2-399 PROBABILISTIC ASSESSMENT OF FLOODING HAZARD FOR NUCLEAR POWER PLANTS
WALL, I. B.
GENERAL ELECTRIC COMPANY, SAN JOSE, CALIF.
A METHOD IS DESCRIBED FOR ESTIMATING THE POTENTIAL HAZARD TO A NUCLEAR POWER STATION FROM MAJOR FLOODING OF A NEARBY RIVER. THE METHOD, APPLIED TO THE MONTICELLO REACTOR SITE FOR ILLUSTRATION, USES HISTORICAL DATA TO ESTIMATE BOTH THE PROBABLE MAGNITUDES AND THE PROBABILITIES OF OCCURRENCE OF FLOODS DURING THE 50-YEAR LIFE OF THE PLANT. THIS APPROACH AVOIDS THE LONG EXTRAPOLATIONS FROM LIMITED DATA ASSOCIATED WITH ATTEMPTS TO ESTIMATE THE MAGNITUDE OF THE PROBABLE MAXIMUM FLOOD, WHICH MAY HAVE A RETURN PERIOD OF 10,000 YEARS, AND PERMITS THE CALCULATION OF CONFIDENCE LIMITS ASSOCIATED WITH DEVIATION FROM THE EXPECTED BEHAVIOR. ON THE BASIS OF ESTIMATES OF POTENTIAL EFFECTS, IT IS CONCLUDED THAT A REASONABLE NUCLEAR PLANT DESIGN BASIS WOULD BE THE FLOOD MAGNITUDE WITH AN OCCURRENCE PROBABILITY OF 10(EXP-4) TO 10(EXP-5) DURING THE NEXT 50-YEAR PERIOD.

15-4-3-409 PROTECTION SYSTEM DEVELOPMENTS AND TRENDS IN THE FEDERAL REPUBLIC OF GERMANY
SCHALLOPP, B.
BURO SCHALLOPP FUR KERNREAKTOR-INSTRUMENTIERUNG, BERLIN, FEDERAL REPUBLIC OF GERMANY
THIS ARTICLE REVIEWS SOME OF THE BASIC IDEAS AND PHILOSOPHIES APPLIED TO REACTOR PROTECTION SYSTEMS IN THE FEDERAL REPUBLIC OF GERMANY FROM THE SPECIAL POINT OF VIEW OF THE AUTHOR. REVIEWED ARE THE IMPLEMENTATION AND APPLICATION OF DESIGNS FOR THE SELF-MONITORING OF ELECTRONIC SYSTEMS AND FOR THE USE OF COMPUTERS IN THE PROTECTION SYSTEMS OF EXISTING NUCLEAR POWER STATIONS.

15-4-3-417 THE 16TH ANNUAL POWER INSTRUMENTATION SYMPOSIUM - CHALLENGES FOR POWER INSTRUMENTATION
SULOUFF, M. D. + HAGEN, E. W.
NUCLEAR PENNSYLVANIA POWER AND LIGHT COMPANY, ALLENTOWN, PA. /
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE 16TH ANNUAL INSTRUMENT SOCIETY OF AMERICA POWER INSTRUMENTATION SYMPOSIUM, GEARED TO THE THEME 'CHALLENGES FOR POWER INSTRUMENTATION,' IS REVIEWED. THE SYMPOSIUM PRESENTED

NEW CONCEPTS IN USING EXISTING PROCESS CONTROL INSTRUMENTATION. A DISCUSSION OF AEC REGULATORY GUIDES AFFECTING INSTRUMENTATION FOR ENVIRONMENTAL MONITORING OF POWER PLANTS, AND THE NEED FOR INDUSTRY STANDARDS. NEW APPROACHES WERE PRESENTED RELATIVE TO CONTROL ROOM DESIGN, SEISMIC QUALIFICATION OF INSTRUMENTATION, DIRECT DIGITAL CONTROL DESIGNS, AND NITROUS OXIDE ABATEMENT.

15-4-4-423 PENETRATION TESTING FOR THE DETERMINATION OF PROPERTIES OF SOILS
ROBINSON, G. C., JR.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
SAFE PERFORMANCE OF MANY NUCLEAR POWER PLANTS IS INHERENTLY RELATED TO SOIL BEHAVIOR, PARTICULARLY AS AFFECTED BY THE LOADINGS THAT EARTHQUAKES MAY IMPOSE. SITES WITH COMPETENT ROCK FOUNDATIONS WILL BE INCREASINGLY DIFFICULT TO ACQUIRE BECAUSE OF INTERRELATIONS WITH ENVIRONMENT, LOAD LOCATION, AND ECONOMIC FACTORS. CONSEQUENTLY THE TECHNIQUES USED FOR ASSESSING SOIL PROPERTIES CONSTITUTE AN INTEGRAL PART OF THE INTERDISCIPLINARY REVIEW OF SUCH FACILITIES. ALTHOUGH STANDARD PENETRATION TESTING IS ONE OF THE MOST WIDELY USED TECHNIQUES FOR ASSESSING SOIL PROPERTIES, ITS LIMITATIONS ARE NOT WELL UNDERSTOOD. THIS ARTICLE REVIEWS THESE LIMITATIONS AND SUGGESTS RECOMMENDATIONS WHEREBY MORE QUANTIFIABLE SOIL TESTS MAY BE POSSIBLE.

15-4-4-432 TORNADO RESISTANT DESIGN OF NUCLEAR POWER PLANT STRUCTURES
MCDONALD, J. R. + MEHTA, K. C. + MINOR, J. E.
TEXAS TECH UNIVERSITY, LUBBOCK, TEXAS
THIS ARTICLE REVIEWS THE VARIOUS FACTORS INVOLVED IN TORNADO RESISTANT DESIGN AND EVALUATES THEIR RELEVANCE IN LIGHT OF CURRENT DESIGN CRITERIA. THE FPP SCALE RATINGS OF STORMS AND THE RECORD KEEPING EFFORTS OF THE NATIONAL SEVERE STORMS FORECAST CENTER IN KANSAS CITY, MO., HAVE GENERATED DATA THAT PROVIDE A MORE CONCISE UNDERSTANDING OF THE GEOGRAPHICAL DISTRIBUTIONS OF TORNADOES AND THEIR INTENSITY. SUCH DATA HAVE RESULTED IN USEFUL REGION CRITERIA FOR THE DESIGN OF TORNADO RESISTANT NUCLEAR PLANTS. THE AEC DESIGN BASIS TORNADO AND ITS IMPLICATIONS ARE DISCUSSED, WITH SPECIFIC REFERENCE TO OCCURRENCE AND INTENSITY DATA, TORNADO - WIND MODELS, TORNADO STRUCTURE INTERACTION, AND TORNADO GENERATED MISSILES. THE USE OF TORNADO - WIND MODELS REPRESENTS A RATIONAL APPROACH TO DETERMINING THE FORCES ON STRUCTURES AND ALSO PROVIDES DATA FOR EVALUATING THE FLIGHT POTENTIAL OF MISSILES. TORNADO STRUCTURE INTERACTION, THE PHENOMENON WHEREBY THE METEOROLOGICAL EFFECTS ARE TRANSLATED INTO LOADS ON THE STRUCTURE, IS DISCUSSED AT LENGTH. A CLEAR UNDERSTANDING OF THESE LOADS CAN LEAD TO ECONOMY OF CONSTRUCTION WITHOUT COMPROMISING SAFETY. CURRENTLY THERE ARE MANY QUESTIONS RELATING TO DESIGN FOR TORNADO GENERATED MISSILES. HOPEFULLY FUTURE RESEARCH IN THIS AREA WILL LEAD TO AN UNDERSTANDING OF THE PHENOMENON AND ALLOW A RELAXING OF THE MISSILE CRITERIA.

15-4-5-440 REVIEW OF FINAL ENVIRONMENTAL STATEMENT CONCERNING THE, AS LOW AS PRACTICABLE HEARING
SNYDER, W. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
(EDITOR'S NOTE - AT THE REQUEST OF THE NUCLEAR SAFETY EDITORS, W. S. SNYDER HAS PREPARED THE FOLLOWING REVIEW OF THE FINAL ENVIRONMENTAL STATEMENT (FES) IN THE 'AS LOW AS PRACTICABLE' HEARING. SNYDER MAKES NO ATTEMPT TO COMMENT ON EXTERNAL EVENTS THAT OCCURRED EITHER BEFORE OR SINCE THE HEARING OR ON INFORMATION INCLUDED IN THE HEARING BUT NOT IN THE FES. HOWEVER, IN THIS REVIEW HE HAS REACHED A COMPROMISE ON THE VARIOUS QUESTIONS AT ISSUE, A COMPROMISE THAT IS COMMENSURATE WITH HIS RESPONSIBILITY IN ACCEPTING THIS TASK.)

15-4-5-443 CONCLUDING STATEMENT OF THE AEC REGULATORY STAFF IN THE, AS LOW AS PRACTICABLE HEARING
(EDITOR'S NOTE - THE CONCLUDING STATEMENT OF THE AEC REGULATORY STAFF IN THE 'AS LOW AS PRACTICABLE' HEARING, DOCKET NO. RM-50-2, WAS ISSUED ON FEB. 20, 1974. IN ADDITION TO THE 145-PAGE STATEMENT, THE REGULATORY STAFF SIMULTANEOUSLY RELEASED A 450-PAGE ATTACHMENT CONTAINING THE TEXT OF FIVE DRAFT REGULATORY GUIDES THAT PROVIDE MODELS AND PARAMETERS FOR CALCULATING AVERAGE EXPECTED RELEASES. THE 'AS LOW AS PRACTICABLE' HEARING, WHICH BEGAN IN JANUARY 1972, IS NOW NEARING COMPLETION, BUT IT WILL BE SEVERAL MONTHS BEFORE THE PROPOSED RULES OR SOME VARIATION OF THEM ARE PUBLISHED IN THE FEDERAL REGISTER WITH AN EFFECTIVE DATE. IN THE MEANTIME, THE REGULATORY STAFF'S CONCLUDING STATEMENT PROVIDES THE BEST INTERIM GUIDANCE AVAILABLE. ALTHOUGH THE LENGTH OF THIS STATEMENT, COMPLETE WITH THE REGULATORY STAFF'S DISCUSSION OF ITS RECOMMENDATIONS AND COST BENEFIT CONSIDERATIONS PRECLUDES PUBLICATION HERE, WE ARE REPRODUCING THE INTRODUCTION TO THE STATEMENT (INCLUDING THE REGULATORY STAFF'S CONCLUSIONS AND RECOMMENDATIONS) AND THE PROPOSED RULE ITSELF. PERSONS INTERESTED IN MORE DETAILS SHOULD EXAMINE THE FULL REPORT, WHICH IS A PART OF THE HEARING RECORD. IN ADDITION, THE FINAL ENVIRONMENTAL STATEMENT IS REVIEWED IN THE PRECEDING ARTICLE OF THIS ISSUE OF NUCLEAR SAFETY. THE TWO SECTIONS OF THE CONCLUDING STATEMENT ARE PRESENTED HERE VERBATIM, INCLUDING THE STAFF'S USE OF FOOTNOTES AND REFERENCES.)

15-4-5-453 POPULATION EXPOSURE TO X-RAYS - U.S. 1970
(EDITOR'S NOTE - WHILE THE NUCLEAR INDUSTRY IS BEING REQUIRED TO REDUCE EXPOSURE LEVELS TO 'AS LOW AS PRACTICABLE,' THE MEDICAL PROFESSION CONTINUES TO BE THE DOMINANT SOURCE OF NONBACKGROUND RADIATION EXPOSURE TO THE POPULATION. THE ENTIRE SUMMARY SECTION OF THE PUBLIC HEALTH SERVICE REPORT ON 'POPULATION EXPOSURE TO X-RAYS - U.S. 1970,' DHEW (FDA) PUBLICATION 73-8047, IS QUOTED BELOW. ALTHOUGH THE REPORT DOES NOT PRESENT A CONCLUSION AS TO THE AVERAGE POPULATION EXPOSURE FROM MEDICAL RADIATION, SUCH A NUMBER MAY BE CALCULATED FROM THE DATA GIVEN. THE 137-PAGE REPORT INCLUDES A COMPREHENSIVE ASSESSMENT OF MEDICAL EXPOSURES IN THE UNITED STATES BY REGIONS, TYPE OF EXAMINATION, AGE OF EQUIPMENT, ETC., WITH THE DETAILED DATA IN APPENDIXES. THE REPORT CARRIES A DATE OF NOVEMBER 1973, ALTHOUGH IT WAS DISTRIBUTED IN APRIL 1974, AND MAY BE PURCHASED FROM THE SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C.)

15-4-6-455 UNEXPECTED MELTDOWN OF SCRAP URANIUM - ALUMINUM CERMET CORES DURING OUTGASSING
GRAY, L. W.
SAVANNAH RIVER LABORATORY, AIKEN, SOUTH CAROLINA
DURING ROUTINE OUTGASSING OF SCRAP URANIUM - ALUMINUM CERMET CORES, UNEXPECTED EXOTHERMIC REACTIONS RELEASED SUFFICIENT ENERGY TO MELT NINE CORES. IN THE SUBSEQUENT INVESTIGATION, COMPOUNDS IN THE SCRAP URANIUM WERE IDENTIFIED, AND THE HISTORY OF THE MATERIAL WAS DEFINED. THE INCIDENT WAS INITIATED BY REACTIONS AT ABOUT 350C BETWEEN POWDERED ALUMINUM METAL AND MIXED URANATE SALTS, WHICH RELEASED SUFFICIENT ENERGY TO INITIATE OTHER ALUMINOTHERMIC REACTIONS. A PLAUSIBLE REACTION SEQUENCE IS POSTULATED TO ACCOUNT FOR THE ENERGY RELEASED IN THE INCIDENT.

15-4-6-463 THE LEAK OF TANK 106-T AT HANFORD
ROBINSON, R. A.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE REVIEWS AN INCIDENT IN WHICH APPROXIMATELY 115,000 GAL OF RADIOACTIVE LIQUID WASTE LEAKED FROM A 533,000-GAL UNDERGROUND STORAGE TANK AT THE HANFORD PLANT OF THE U.S. ATOMIC ENERGY COMMISSION IN 1973. THE ENSUING INVESTIGATION INDICATED THAT THE LEAKED MATERIAL WAS RETAINED IN THE SOIL IN THE VICINITY OF THE WASTE TANKS AND POSED NO THREAT TO THE WORKERS AND THE NEARBY COLUMBIA RIVER. HOWEVER, THE INVESTIGATION DID POINT OUT THE NEED FOR IMPROVED MONITORING PROCEDURES, WHICH ARE PRESENTLY BEING IMPLEMENTED.

15-5-1-513 SAFEGUARDS AGAINST THE THEFT OR DIVERSION OF NUCLEAR MATERIALS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
DIVERSION OF SPECIAL NUCLEAR MATERIAL PRESENTS A THREAT AS AN EXPLOSIVE WEAPON, AS A BIOLOGICAL POISON, OR AS A RADIATION SOURCE. HOWEVER, THERE ARE ONLY A FEW STEPS IN THE NUCLEAR FUEL CYCLE WHICH ARE VULNERABLE TO DIVERSION OR SABOTAGE. THESE STEPS ARE IDENTIFIED. THE PROTECTIVE MEASURES REQUIRED BY THE COMMISSION BOTH ON SITE AND IN TRANSIT ARE DESCRIBED, AS ARE THE RESEARCH AND DEVELOPMENT THAT ARE UNDER WAY TO IMPROVE THE CAPABILITY OF THE U.S. SAFEGUARDS.

15-5-1-519 UNDERGROUND NUCLEAR PLANT SITING - A TECHNICAL AND SAFETY ASSESSMENT
CROWLEY, J. M. + DOAN, P. L. + MCCREATH, D. N.
UNITED ENGINEERS AND CONSTRUCTORS, INC., PHILADELPHIA, PA.
THE SITING OF NUCLEAR PLANTS UNDERGROUND IS EXAMINED BROADLY ON THE BASIS OF TECHNICAL FEASIBILITY, DESIGN, SAFETY, AND ECONOMICS. DISCUSSION IS GENERAL FOR ALL REACTOR TYPES AND UNDERGROUND SITING ALTERNATIVES, BUT SPECIFIC DETAILS ARE MAINLY REFERRED TO A 1000-MW PRESSURIZED WATER REACTOR LOCATED IN A DEEP ROCK CAVERN. CONCLUSIONS ARE THAT CURRENT TECHNOLOGY IS ENTIRELY ADEQUATE AND THAT THE ENHANCED SAFETY POSTURE OF AN UNDERGROUND SITE MAY FACILITATE CLOSE-IN SITING AND WITH NO GREATER RISK OR POSSIBLY LESS THAN THAT OF A SURFACE SITE. ECONOMIC TRADE-OFFS ARE IDENTIFIED, AND IT HAS NOT BEEN CLEARLY ESTABLISHED THAT UNDERGROUND SITING WOULD RESULT IN AN ECONOMIC PENALTY.

15-5-2-535 COMPUTER CODES FOR ANALYZING NUCLEAR ACCIDENTS
WINTON, M. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
MANY COMPUTER CODES HAVE BEEN DEVELOPED FOR USE IN VARIOUS ASPECTS OF NUCLEAR ACCIDENT ANALYSIS. THE NUCLEAR SAFETY INFORMATION CENTER HAS SEPARATED OVER 180 OF THESE CODES INTO 13 GROUPS AND TABULATED THEM. THE RESULTING TABLE GIVES NAME OF CODE, MACHINE ON WHICH IT IS OPERABLE, ITS LANGUAGE, CORPORATE AUTHOR, A STATEMENT OF WHAT THE CODE DOES, A REFERENCE CITATION, AND DATE OF THE REFERENCE.

15-5-3-554 A PROGRESS REPORT ON THE USE OF ACOUSTIC EMISSION TO DETECT INCIPIENT FAILURE IN NUCLEAR PRESSURE VESSELS
BELL, R. L.
CELSCO, CANOGA PARK, CALIF.
SIGNIFICANT ADVANCES IN THE TECHNOLOGY AND APPLICATION OF THE ACOUSTIC EMISSION PHENOMENON TO DETECTION, LOCATION, AND CHARACTERIZATION OF INCIPIENT FAILURE MECHANISMS IN PRESSURE VESSELS HAVE BEEN MADE OVER THE LAST SEVERAL YEARS. IN ADDITION

TO PROGRAMS CARRIED OUT BY DEVELOPMENT LABORATORIES AND PRIVATE RESEARCH FACILITIES. THE GOVERNMENT AND THE UTILITY INDUSTRY HAVE ALSO SPONSORED PROGRAMS THAT HAVE GREATLY INCREASED THE SCOPE AND APPLICABILITY OF THE TECHNIQUE TO NUCLEAR PRESSURE VESSEL INSPECTION. BOTH PERIODIC HYDROTEST MONITORING WITH ACOUSTIC EMISSION AND CONTINUOUS ACOUSTIC EMISSION SURVEILLANCE ARE FEASIBLE FOR APPLICATION TO BOILING WATER REACTOR AND PRESSURIZED WATER REACTOR PRESSURE VESSELS. BOTH APPROACHES HAVE THEIR LIMITATIONS AND ADVANTAGES BUT, IN GENERAL, APPEAR TO PROVIDE MORE INFORMATION ON THE INTEGRITY OF THE NUCLEAR PRESSURE VESSEL THAN ANY OTHER NONDESTRUCTIVE TESTING TECHNIQUE PRESENTLY USED. ALTHOUGH RESEARCH AND DEVELOPMENT WORK IS CONTINUING WITH REGARD TO BETTER DETERMINING THE SEVERITY OF THE ACOUSTIC EMISSION SOURCES, CONSIDERABLE FIELD APPLICATION IS ALREADY PROVIDING USEFUL BASE-LINE AND OPERATING INFORMATION.

15-5-4-572 THE NUCLEAR SAFETY PROGRAM AT DOW CHEMICAL COMPANYS ROCKY FLATS PLANT I.
SCHUSKE, C. L. + MCCARTHY, J. C.
THE DOW CHEMICAL COMPANY, GOLDEN, COLO.
THE NUCLEAR SAFETY PROGRAM FOR THE DOW-AEC PRODUCTION AND RESEARCH COMPLEX AT ROCKY FLATS BEGAN IN 1952. SINCE THEN, CONSIDERABLE CHANGES HAVE BEEN MADE IN THE RESPONSIBILITIES OF THE NUCLEAR SAFETY AND OPERATING GROUPS. THESE RESPONSIBILITIES INCLUDE THE TRAINING OF PERSONNEL, THE AUDITING OF OPERATIONS, AND THE PERFORMING OF MAXIMUM CREDIBLE ACCIDENT REVIEWS OF PLANT FACILITIES. SIGNIFICANT CHANGES IN ADMINISTRATIVE POLICIES AND DOCUMENTATION OF THESE POLICIES WERE BROUGHT ABOUT OWING TO THE INFLUENCE OF THE COMPANY MANAGEMENT COMMITTEES AND THE AEC ALBUQUERQUE OPERATIONS OFFICE. THESE CHANGES ARE DISCUSSED HERE. PART II, TO APPEAR IN THE NEXT ISSUE OF NUCLEAR SAFETY, DISCUSSES THE IMPACT OF OUR EXPERIMENTAL AND COMPUTATIONAL PROGRAMS ON PLANT OPERATIONS.

15-5-5-585 THE LAW AND LOW LEVEL RADIATION
EASON, C. F. + ST. DENIS, N. Y.
U. S. ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.
ONE OF THE RESPONSIBILITIES OF THE HEALTH PHYSICIST IS TO RECOMMEND AND ENFORCE RADIATION PROTECTION STANDARDS BASED UPON RECOGNIZED OCCUPATIONAL RADIATION EXPOSURE GUIDES. IT FOLLOWS, THEREFORE, THAT THE HEALTH PHYSICIST, BECAUSE OF HIS BACKGROUND AND TECHNICAL KNOWLEDGE, WILL PLAY A KEY ROLE IN EVALUATING A CLAIM ALLEGEDLY ARISING OUT OF EXPOSURE TO IONIZING RADIATION. THIS ARTICLE EXAMINES A NUMBER OF LATENT RADIATION INJURY CASES WITH PARTICULAR EMPHASIS ON THE KINDS OF RADIATION RECORDS OFFERED IN EVIDENCE, THE NATURE OF THE EXPERT TESTIMONY BY BOTH THE HEALTH PHYSICIST AND THE MEDICAL EXPERT, AND THE CONCLUSIONS OF THE COURT OR BOARD IN THE FINAL ADJUDICATION OF THE CLAIM. THE ARTICLE ALSO EXPLORES THE VIEWS OF THOSE WHO HOLD THAT THE PRESENT LEGAL SYSTEM IN THE UNITED STATES IS NOT APPROPRIATE FOR THE HANDLING OF LATENT INJURY CLAIMS.

15-5-5-592 SYMPOSIUM ON COOLING-TOWER ENVIRONMENT - 1974
TAYLOR, F. G., JR.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A SYMPOSIUM CONCERNING THE ENVIRONMENTAL ASPECTS OF COOLING TOWERS WAS HELD AT THE UNIVERSITY OF MARYLAND, COLLEGE PARK, MD., MAR. 4-6, 1974. THE MEETING, SPONSORED BY THE U.S. ATOMIC ENERGY COMMISSION AND THE STATE OF MARYLAND POWER PLANT SITING PROGRAM, CONSISTED OF SIX TECHNICAL SESSIONS WITH INVITED SPEAKERS FROM UNIVERSITY, GOVERNMENT, INDUSTRY, AND UTILITY SPECIALISTS PRESENTING A STATE OF THE ART SURVEY. ATTENDANCE WAS LIMITED BY INVITATION TO THOSE ACTIVELY INVOLVED IN COOLING TOWER RESEARCH IN ORDER TO ENHANCE THE FREE EXCHANGE OF IDEAS IN DISCUSSION FOLLOWING THE PRESENTATIONS. ONE HUNDRED AND FIFTY ATTENDEES, INCLUDING REPRESENTATIVES FROM FOUR FOREIGN COUNTRIES, EXCHANGED VIEWS TO MESH THE VARIED TECHNICAL SESSIONS INTO A COMPREHENSIVE SYMPOSIUM.

15-5-5-599 EVALUATION OF NUCLEAR POWER PLANT AVAILABILITY
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A STUDY WAS MADE OF NUCLEAR AND FOSSIL POWER PLANT OPERATING EXPERIENCE TO COMPARE PLANT AVAILABILITY AND TO DETERMINE THE CAUSE AND SAFETY SIGNIFICANCE OF PLANT OUTAGES FOR NUCLEAR PLANTS. RESULTS SHOWED THAT THE AVAILABILITY OF THE NUCLEAR POWER PLANTS IS LOWER THAN THE GENERAL DESIGN OBJECTIVE DURING THE FIRST 1 TO 3 YEARS OF COMMERCIAL SERVICE. FOLLOWING THIS PERIOD OF OPERATION, HOWEVER, AVERAGE AVAILABILITY HAS APPROACHED OR EXCEEDED 80 PERCENT. THE AVERAGE AVAILABILITY OF NUCLEAR PLANTS HAS BEEN NEARLY THE SAME AS THAT OF FOSSIL PLANTS OF APPROXIMATELY THE SAME SIZE DURING THE 12-YEAR PERIOD 1960 TO 1971. APPROXIMATELY HALF OF THE FORCED OUTAGES OF NUCLEAR PLANTS RESULTED FROM EVENTS THAT ARE CONSIDERED TO HAVE SAFETY SIGNIFICANCE. IN NO CASE, HOWEVER, WAS THERE INJURY TO THE PUBLIC OR A RELEASE OF RADIOACTIVE MATERIALS IN EXCESS OF PERMISSIBLE LEVELS.

15-6-1-651 NOVEL SITING SOLUTIONS FOR NUCLEAR POWER PLANTS
YADIGAROGLU, G. + ANDERSEN, S. O.
UNIVERSITY OF CALIFORNIA, BERKELEY, CALIF.
THIS ARTICLE IS A REVIEW OF THE CONFERENCE ON NOVEL SITING SOLUTIONS FOR NUCLEAR POWER PLANTS, HELD IN SAN FRANCISCO, CALIF., NOV. 8-9, 1973. THE STATE OF THE ART OF MAJOR TECHNOLOGIES FOR OFFSHORE AND UNDERGROUND SITING IS REVIEWED BOTH IN TERMS OF DECOUPLING THE LICENSING OF REACTORS FROM SITE RELATED ENVIRONMENTAL FACTORS AND ENGINEERING, FINANCIAL, AND REGULATORY UNCERTAINTIES. PROBLEMS OF COMPREHENSIVE SITE EVALUATION AND TECHNOLOGY ASSESSMENT ASSOCIATED WITH THESE INNOVATIVE CONCEPTS ARE ALSO DISCUSSED. THE CONFERENCE PARTICIPANTS AGREED THAT MAJOR NEW TECHNOLOGIES FOR EXTENDING SITING OPTIONS ARE AVAILABLE. OFFSHORE BREAKWATER PROTECTED POWER PLANTS SEEM TO ENJOY ALMOST UNIVERSAL ACCEPTANCE AMONG ARCHITECT ENGINEER AND UTILITY PLANNERS, BUT OPINIONS WERE STRONGLY DIVIDED ON THE SAFETY AND ECONOMICS OF OTHER NOVEL CONCEPTS.

15-6-1-665 BENEFIT COST ANALYSES IN LICENSING OF NUCLEAR POWER REACTORS
HILL, R. W. + BRYAN, R. H. + NICHOLS, B. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE DESCRIBES THE EVOLUTION OF A METHOD USED TO DEVELOP BENEFIT COST ANALYSES FOR INCLUSION IN ENVIRONMENTAL STATEMENTS PREPARED FOR THE AEC DIRECTORATE OF LICENSING. THE ARTICLE DISCUSSES (1) THE HISTORY OF THE FEDERAL GOVERNMENTS DEVELOPMENT OF BENEFIT COST ANALYSES FOR WATER RESOURCES PROJECTS, (2) THE EFFECT OF THE CALVERT CLIFFS CASE ON AEC LICENSING ACTIVITIES, (3) THE DEVELOPMENT OF AEC GUIDES FOR PREPARATION OF ENVIRONMENTAL REPORTS AND BENEFIT COST ANALYSES AND THEIR EFFECT ON OTHER ACTIVITIES, AND (4) SOME POSSIBLE TRENDS IN THE DEVELOPMENT AND USE OF BENEFIT COST ANALYSES DEVELOPED FOR ENVIRONMENTAL REPORTS AND STATEMENTS.

15-6-1-673 AN ASSESSMENT OF ACCIDENT RISKS IN U.S. COMMERCIAL NUCLEAR POWER PLANTS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE AEC HAS SPONSORED THIS STUDY, ALSO KNOWN AS THE REACTOR SAFETY STUDY, TO MAKE A QUANTITATIVE ASSESSMENT OF THE POTENTIAL RISKS INVOLVED IN NUCLEAR POWER PLANT ACCIDENTS. THE STUDY GROUP, WHICH WAS DIRECTED BY DR. NORMAN C. RASMUSSEN, HAS COMPLETED 2 YEARS OF WORK AND PREPARED A DRAFT REPORT ENTITLED AN ASSESSMENT OF ACCIDENT RISKS IN U.S. COMMERCIAL NUCLEAR POWER PLANTS. THIS PRODIGIOUS REPORT CONSISTS OF OVER 3000 PAGES BUT FOR CONVENIENCE IS DIVIDED INTO 14 SEPARATE VOLUMES. THE SUMMARY REPORT CONSISTS OF 29 PAGES, AND THE MAIN REPORT HAS 248 PAGES. THE REMAINDER OF THE REPORT CONSISTS OF APPENDIXES. REPRINTED BELOW IS THE SECTION ENTITLED INTRODUCTION AND RESULTS FROM THE DRAFT SUMMARY REPORT. WHILE THE STUDY HAS PRESENTED THE ESTIMATED RISKS FROM NUCLEAR POWER PLANT ACCIDENTS AND COMPARED THEM WITH OTHER RISKS THAT EXIST IN OUR SOCIETY, IT HAS MADE NO JUDGMENT ON THE ACCEPTABILITY OF NUCLEAR RISKS. ALTHOUGH THE STUDY BELIEVES NUCLEAR ACCIDENT RISKS ARE VERY SMALL, THE JUDGMENT AS TO WHAT LEVEL OF RISK SOCIETY SHOULD ACCEPT IS A BROADER ONE THAN CAN BE MADE HERE.

15-6-2-676 LOSS OF FLUID TEST INTEGRAL TEST FACILITY AND PROGRAM
COPLEN, H. L. + YBARRONDO, L. J.
AEROJET NUCLEAR COMPANY, IDAHO FALLS, IDAHO
THE LOSS OF FLUID TEST INTEGRAL TEST FACILITY WAS DESIGNED TO SIMULATE, AS NEARLY AS POSSIBLE, ALL THE IMPORTANT EFFECTS THAT ARE ANTICIPATED TO OCCUR DURING A LOSS OF COOLANT ACCIDENT IN A LARGE PRESSURIZED WATER REACTOR TYPE NUCLEAR STEAM SUPPLY SYSTEM. INTEGRAL, AS USED HERE, DEFINES AN EXPERIMENT COMBINING THE NUCLEAR, THERMAL, HYDRAULIC, AND STRUCTURAL PROCESSES OCCURRING DURING A LOSS OF COOLANT ACCIDENT AS OPPOSED TO THE SINGLE AND DUAL EFFECT, NON NUCLEAR, SMALL SCALE, THERMOHYDRAULIC EXPERIMENTS CONDUCTED TO DATE. A MINIMUM OF 19 LOSS OF COOLANT EXPERIMENTS IS PLANNED IN THE LOSS OF FLUID TEST WITH VARIOUS SIMULATED LINE BREAK LOCATIONS AND SIZES, INCLUDING SOME INITIAL ISOTHERMAL TESTS USING A CORE SIMULATOR RATHER THAN THE ACTUAL FUEL ASSEMBLIES.

15-6-3-691 COMPUTER CONTROL AT BRUCE NUCLEAR GENERATING STATION
MORRIS, D. I.
ATOMIC ENERGY OF CANADA LIMITED, SHERIDAN PARK, ONTARIO, CAN.
THE 3000-MW(E) BRUCE NUCLEAR GENERATING STATION, SCHEDULED TO GO CRITICAL IN SEPTEMBER 1975, UTILIZES DIRECT DIGITAL CONTROL FOR REACTOR REGULATION AND ELECTRIC POWER OUTPUT IN A REACTOR FOLLOWING TURBINE MODE. THE DESIGN AND OPERATING PHILOSOPHIES HAVE BEEN IMPLEMENTED SUCCESSFULLY AT OTHER NUCLEAR STATIONS WHICH ARE PRESENTLY PRODUCING POWER. THE COMPUTERS, PERIPHERALS, AND SOFTWARE OPERATING SYSTEM ARE DESIGNED TO PROVIDE A VARIETY OF HARDWARE AND SOFTWARE SELF-CHECKING FUNCTIONS SO THAT TRANSFER OF CONTROL TO THE STANDBY SYSTEM CAN BE CARRIED OUT AUTOMATICALLY AND CAN BE EITHER PARTIAL OR TOTAL, DEPENDING ON WHICH THE PARTICULAR FAILURE MODE WARRANTS. THE MAIN TASK OF THE DUAL DIGITAL COMPUTERS IS TO PROVIDE UNIT REACTOR POWER REGULATION TO CONTROL THE GENERATION OF ELECTRIC POWER TO AN OPERATOR ENTERED VALUE. A NUMBER OF FUNCTIONALLY INDEPENDENT PROGRAMS PROVIDE DIRECT DIGITAL CONTROL IN THE FORM

OF ANALOG OR DIGITAL OUTPUTS TO DEVICES IN THE FIELD, SO THAT THE ENTIRE OPERATION FROM REACTOR *ARMUP TO 100 PERCENT ELECTRIC POWER OUTPUT IS DONE WITHOUT OPERATOR INTERVENTION. THE MAJORITY OF THE ALARM ANNUNCIATION REQUIREMENTS FOR THE GENERATING UNIT ARE HANDLED BY THE CONTROL COMPUTERS UTILIZING HIGH-SPEED PRINTERS AND CATHODE-RAY TUBE DISPLAYS. AN EXTENSIVE OPERATOR INTERACTIVE GRAPHICAL DISPLAY SYSTEM, *HICH HAS REDUCED THE CONGESTION OF CONTROL-PANEL INSTRUMENTATION, HAS BEEN INCORPORATED IN THE UNIT'S DIGITAL CONTROL COMPUTER SYSTEM.

15-6-3-702 A SURVEY OF APPLIED INSTRUMENT SYSTEMS FOR USE WITH LIGHT *ATER REACTOR CONTAINMENTS
TUXEN-MEYER, H.
AB ATOMENERGI, SWEDISH ATOMIC ENERGY ESTABLISHMENT
THIS ARTICLE SUMMARIZES DATA RELATED TO THE INSTRUMENTATION, TESTING PRACTICES, AND MONITORING PROCEDURES FOR BOILING AND PRESSURIZED WATER REACTOR CONTAINMENT ATMOSPHERES. QUESTIONNAIRES WERE SENT TO A REPRESENTATIVE SELECTION OF REACTOR INSTALLATIONS IN THE UNITED STATES, WEST GERMANY, AND SWEDEN WHICH HAD EITHER RECENTLY STARTED OPERATION OR WERE STILL UNDER CONSTRUCTION. COMPILATION OF THE ANSWERS IN TABULAR FORM REVEALED SURPRISING DIFFERENCES BETWEEN THE DIFFERENT INSTRUMENT ARRAYS IN REGARD TO THE DESIGN CRITERIA EMPLOYED. THE SURVEY INDICATES THAT FURTHER INFORMATION REGARDING INSTRUMENTATION PHILOSOPHY IS NEEDED.

15-6-4-711 ELEMENTAL IODINE AND METHYL IODIDE ADSORPTION ON ACTIVATED CHARCOAL AT LOW CONCENTRATIONS
BELLAMY, R. R.
U. S. ATOMIC ENERGY COMMISSION.
THE CAPABILITY OF ACTIVATED CHARCOAL TO ADSORB ELEMENTAL IODINE AND METHYL IODIDE AT LOW CONCENTRATIONS HAS BEEN EXPERIMENTALLY EVALUATED TO OBSERVE THE EFFECT OF THE VARIATION OF CERTAIN OPERATING PARAMETERS WITHIN SPECIFIED LIMITS. THE OPERATING PARAMETERS INCLUDE INLET CONCENTRATION, SUPERFICIAL VELOCITY, RELATIVE HUMIDITY, TYPE OF CHARCOAL AND IMPREGNANT, CHARCOAL MESH SIZE, DURATION OF TEST, AND BED DEPTH. THE DATA OBTAINED IN AN INTENSIVE STUDY OF THESE PARAMETERS HAVE BEEN CORRELATED ASSUMING A TWO-STEP ADSORPTION MECHANISM FOR RADIOIODINE ON ACTIVATED CHARCOAL. THE CORRELATION IS PRESENTED TO AID THE NUCLEAR INDUSTRY IN DESIGNING CHARCOAL ADSORBER SYSTEMS FOR RADIOIODINE RETENTION.

15-6-4-723 THE NUCLEAR SAFETY PROGRAM AT DOW CHEMICAL COMPANY ROCKY FLATS PLANT II.
SCHUSKE, C. L. + MCCARTHY, J. O.
DOW CHEMICAL COMPANY, GOLDEN, COLO.
THIS IS THE SECOND PART OF A TWO PART ARTICLE ON THE NUCLEAR SAFETY PROGRAM AT DOW CHEMICAL COMPANY'S PRODUCTION AND RESEARCH COMPLEX AT ROCKY FLATS, GOLDEN, COLO. PART I (NUCL. SAFETY, 15(5)) DESCRIBED THE ADMINISTRATIVE AND CONTROL ASPECTS OF THE PROGRAM. PART II DISCUSSES THE EXPERIMENTAL AND COMPUTATIONAL PROGRAMS. THESE PROGRAMS HAVE CONTRIBUTED DATA ON THE CRITICALITY PARAMETERS NEEDED IN THE DESIGN OF NEW EQUIPMENT AND FACILITIES, AS WELL AS THE EVALUATION OF EXISTING FACILITIES. THESE DATA HAVE RESULTED IN UNIQUE EQUIPMENT DESIGNS, SUCH AS METAL MELTING CRUCIBLES AND STORAGE FACILITIES IN WHICH DOUBLING AND TRIPLING OF PROCESS BATCHES NOT PREVIOUSLY PERMITTED HAVE BEEN SAFELY ACCOMPLISHED. THESE INNOVATIONS HAVE CONSEQUENTLY LED TO MONETARY SAVINGS IN HANDLING OF FISSILE MATERIALS.

15-6-5-732 BIOLOGICAL EFFECTS OF NOBLE GASES (A REVIEW OF SELECTED PAPERS PRESENTED AT THE 1973 NOBLE GASSES SYMPOSIUM AT LAS VEGAS)
ROHWER, P. S. + BARTON, C. J.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE NOBLE GASES SYMPOSIUM HELD IN LAS VEGAS, NEV., SEPT. 24 TO 28, 1973, COVERED ALL IMPORTANT ASPECTS OF THIS TOPIC, INCLUDING THE BIOLOGICAL EFFECTS CONSIDERED HERE. SEPARATE SESSIONS WERE DEVOTED TO THE BIOLOGICAL EFFECTS OF RADON AND OF THE OTHER NOBLE GASES, BUT SPECIAL ATTENTION WAS FOCUSED ON KRYPTON-85, THE LONGEST-LIVED NOBLE GAS RELEASED FROM NUCLEAR FACILITIES, PRINCIPALLY FUEL REPROCESSING PLANTS. THE COST BENEFIT ASPECT OF LIMITING EXPOSURE OF THE WORLD POPULATION TO LOW CONCENTRATIONS OF THIS RADIONUCLIDE WAS DISCUSSED EXTENSIVELY DURING THE SYMPOSIUM. THE MAJORITY OF THE PARTICIPANTS FELT THAT EFFECTIVE CONTROLS ON LARGE SCALE EMISSIONS OF KRYPTON-85, SUCH AS THOSE FROM FUEL REPROCESSING PLANTS, SHOULD BE INSTITUTED AS SOON AS PRACTICABLE SO AS TO MINIMIZE POSSIBLE GENETIC EFFECTS FROM THIS MAN MADE RADIOACTIVITY.

15-6-6-738 U.S. NUCLEAR POWER PLANT AVAILABILITY AND CAPACITY STATISTICS FOR 1973
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
STATISTICAL INFORMATION CONCERNING NUCLEAR POWER PLANT AVAILABILITY, PLANT CAPACITY, AND REACTOR AVAILABILITY FACTORS FOR 1973 WAS COMPILED FROM SEMIANNUAL REPORTS SUBMITTED TO THE U.S. ATOMIC ENERGY COMMISSION (AEC). STATISTICS SHOWED THAT PLANT AVAILABILITY DURING 1973 WAS SLIGHTLY LOWER THAN THAT REPORTED FOR 1972. A PREVIOUS OBSERVATION CONCERNING ATTAINMENT OF, AND CONTINUED PERFORMANCE AT, 80 PERCENT AVAILABILITY AFTER 3 TO 4 YEARS' OPERATION WAS NOT SUBSTANTIATED BY EXPERIENCE DURING 1973 BECAUSE OF EXTENSIVE OUTAGES AT A FEW PLANTS THAT

STRONGLY INFLUENCED THE AVERAGES FOR THE SMALL NUMBER OF PLANTS THAT HAVE BEEN IN OPERATION FOR 3 YEARS OR MORE. HOWEVER, PLANT AVAILABILITY AND CAPACITY FACTORS FOR NUCLEAR POWER PLANTS ARE COMPARABLE TO THOSE REPORTED ELSEWHERE FOR FOSSIL FUELED POWER PLANTS OF COMPARABLE SIZES AND AGES.

16-1-1-1 AEC WORKING PAPER ON POPULATION DENSITY AROUND NUCLEAR POWER PLANT SITES
BUCHANAN, J. R.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE REVIEWS A PROPOSED REGULATORY GUIDE, POPULATION DISTRIBUTION AROUND NUCLEAR POWER PLANTS, WHICH THE AEC CONSIDERED ISSUING TO PROVIDE GUIDANCE ON ACCEPTABLE POPULATION CHARACTERISTICS FOR A NUCLEAR REACTOR SITE. THE PROPOSED AEC GUIDE INVOLVED CUMULATIVE POPULATION PROJECTIONS WITHIN 5, 20, AND 40 MILES OF THE SITE. TWO TECHNIQUES FOR EVALUATING POPULATION DISTRIBUTIONS AROUND SITES ARE ALSO DISCUSSED. THE FIRST TECHNIQUE IS THE USE OF AN UNWEIGHTED CUMULATIVE POPULATION VS. DISTANCE. THE SECOND TECHNIQUE IS CALLED A SITE POPULATION FACTOR FOR THE PURPOSE OF COMPARING SITES, AND THIS TECHNIQUE WEIGHTS POPULATION AT LONGER DISTANCES LESS THAN THE POPULATION ADJACENT TO A SITE. THE AEC IS CONTINUING WORK ON THESE POTENTIAL TOOLS. ALL PRESENTLY APPROVED SITES HAVE BEEN FOUND TO BE ACCEPTABLE IN TERMS OF POPULATION DENSITY AS WELL AS BY OTHER CONSIDERATIONS.

16-1-1-8 WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
CUTTRELL, W. B. + ROBSON, D. G. + SMITMAN, G. D.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE IS A REVIEW OF THE SECOND WATER REACTOR SAFETY RESEARCH INFORMATION MEETING, SPONSORED BY THE AEC DIVISION OF REACTOR SAFETY RESEARCH, HELD AT AEC HEADQUARTERS, GERMANTOWN, MD., SEPT. 19-20, 1974. THIS MEETING, ALTHOUGH SIMILAR IN SCOPE TO THE FIRST MEETING, WAS ORGANIZED SOMEWHAT DIFFERENTLY IN THAT THERE WERE ONLY FOUR TECHNICAL SESSIONS, WITH PARALLEL SESSIONS ON BOTH DAYS. THE TECHNICAL SESSIONS WERE (1) LOSS OF COOLANT ACCIDENT (LOCA) TEST PROGRAM, (2) FUEL BEHAVIOR PROGRAM, (3) PRIMARY SYSTEM INTEGRITY PROGRAM, AND (4) CODE DEVELOPMENT PROGRAM. OVER 275 PERSONS, INCLUDING SEVERAL FOREIGN REPRESENTATIVES, ATTENDED THE MEETING. BUT NO PROCEEDINGS ARE PLANNED. IT IS APPARENT FROM THE QUANTITY AND QUALITY OF THE TECHNICAL ACHIEVEMENTS REPORTED AT THE MEETING THAT THE CHANGES IN EXPERIMENTAL PROGRAMS, INCLUDING CONSTRUCTION AND/OR MODIFICATIONS OF FACILITIES WHICH SO DOMINATED THE TALKS AT THE FIRST MEETING, ARE BEGINNING TO PRODUCE RESULTS. BRIEF SUMMARIES OF MANY PRESENTATIONS ARE INCLUDED.

16-1-2-2 BURNOUT IN BOILING HEAT TRANSFER I. POOL BOILING SYSTEMS
BERGLES, A. E.
IOWA STATE UNIVERSITY, IOWA CITY, IA.
RECENT EXPERIMENTAL AND ANALYTICAL DEVELOPMENTS IN POOL BOILING BURNOUT ARE REVIEWED, AND RESULTS ARE SUMMARIZED THAT CLARIFY THE DEPENDENCE OF CRITICAL HEAT FLUX ON HEATER GEOMETRY AND FLUID PROPERTIES. NEW ANALYTICAL INTERPRETATIONS OF BURNOUT ARE DISCUSSED, AND THE EFFECTS OF SURFACE CONDITION, AGING, ACCELERATION, AND TRANSIENT HEATING (OR COOLING) ARE DESCRIBED. AUGMENTATION OF CRITICAL HEAT FLUX, THE RELATION OF SOUND TO BURNOUT, AND NEW TECHNIQUES FOR STABILIZING ELECTRIC HEATERS AT BURNOUT ARE ALSO CONSIDERED.

16-1-4-43 RADIONUCLIDE BEHAVIOR DURING NORMAL OPERATION OF LIQUID METAL COOLED FAST BREEDER REACTORS I. PRODUCTION
EKDMAN, C. A. + REYNOLDS, A. B.
UNIVERSITY OF VIRGINIA, CHARLOTTESVILLE, VA.
THIS ARTICLE, PRESENTED IN TWO PARTS, REVIEWS THE BEHAVIOR OF RADIONUCLIDES PRODUCED DURING THE NORMAL OPERATION OF A LIQUID METAL COOLED FAST BREEDER REACTOR (LMFBR). THE RESULTS GIVEN ARE PRIMARILY FROM THE LITERATURE, BUT SEVERAL INDEPENDENT CALCULATIONS ARE INCLUDED. NUMERICAL RESULTS ARE NORMALIZED TO A 1000-MW(E) LMFBR AND ARE COMPARED WITH A SIMILAR SIZE LIGHT WATER REACTOR. SOURCES OF RADIOACTIVITY STUDIED INCLUDE PLUTONIUM AND OTHER TRANSURANIC ELEMENTS, FISSION PRODUCTS, TRITIUM, CORROSION PRODUCTS, ACTIVATION PRODUCTS, AND TRAMP FUEL. THE REVIEW ALSO INCLUDES DATA ON RADIOACTIVITY TAKEN FROM THE OPERATING EXPERIENCES OF LMFBRS. DATA ARE INCLUDED FOR THE FAST REACTORS EBR-II, FERMI, SEFOR, DOUNREAY, RAPSODIE, AND BR-5, WITH LIMITED DATA FOR THE THERMAL REACTORS SRE, SUSER, AND HALLAM. THIS ARTICLE (PART 1) DISCUSSES THE PRODUCTION OF RADIOACTIVITY. PART 2, SCHEDULED FOR NUCLEAR SAFETY, 16(3), WILL DISCUSS THE TRANSPORT OF RADIOACTIVITY.

16-1-5-60 THE CONTROL, MONITORING, AND REPORTING OF RADIOACTIVITY IN EFFLUENTS I. AEC OWNED FACILITIES
BILES, M. B. + COFFMAN, F. E.
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, WASHINGTON, D. C.
PROGRAMS FOR MONITORING AND REPORTING OF RADIOACTIVITY IN EFFLUENTS ARE MAINTAINED AT ALL U.S. ATOMIC ENERGY COMMISSION (AEC) FACILITIES DISCHARGING CONCENTRATIONS OF RADIOACTIVITY THAT HAVE POTENTIAL HEALTH AND SAFETY OR ENVIRONMENTAL SIGNIFICANCE. TO ENSURE THE EFFECTIVE MANAGEMENT AND CONTROL OF EFFLUENTS IS THE OBJECTIVE OF THESE PROGRAMS. THE NATURE AND QUANTITIES OF RADIOACTIVITY DISCHARGED TO THE ENVIRONMENT VARY WIDELY FROM SITE TO SITE, PRIMARILY OWING TO THE WIDE VARIETY

OF OPERATIONS AND FACILITIES. EFFLUENT CONTROL PROGRAMS AT AEC SITES ARE PRIMARILY BASED ON GUIDANCE PROMULGATED BY THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION, THE NATIONAL COUNCIL ON RADIATION PROTECTION, AND THE FEDERAL RADIATION COUNCIL. TO MAINTAIN AN OVERVIEW OF ITS EFFLUENT CONTROL PRACTICES, THE AEC HAS DEVELOPED AND INSTITUTED A COMPUTER BASED ANNUAL EFFLUENT DATA REPORTING SYSTEM TO ENSURE THAT EFFLUENT CONTROL PROGRAMS ARE PROPERLY MAINTAINED. THIS SYSTEM HAS PROVED TO BE A VERY USEFUL INTERNAL MANAGEMENT TOOL FOR EVALUATING THE EFFECTIVENESS OF EFFLUENT CONTROL PROGRAMS AND FOR IDENTIFYING POTENTIAL PROBLEM AREAS. AN EFFLUENT REDUCTION PROGRAM THAT FOCUSES ON THE REDUCTION OF QUANTITIES RATHER THAN CONCENTRATIONS OF RADIOACTIVITY HAS RESULTED IN SUBSTANTIAL REDUCTIONS IN QUANTITIES OF RADIOACTIVITY RELEASED FROM SELECTED FACILITIES.

16-1-5-71 THE CONTROL, MONITORING, AND REPORTING OF RADIOACTIVITY IN EFFLUENTS II. AEC LICENSED FACILITIES
HIGGINBOTHAM, L. B. + COLLINS, J. T.
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C. AND ENVIRONMENT CONSULTANTS, INC., DALLAS, TEX.
PROGRAMS FOR CONTROL AND MONITORING OF RADIOACTIVE EFFLUENTS ARE REQUIRED AT ALL FACILITIES REGULATED BY THE U.S. ATOMIC ENERGY COMMISSION (AEC). LIMITATIONS AND REQUIREMENTS FOR CONTROL AND MONITORING OF RADIOACTIVE EFFLUENTS ARE EXPRESSED IN AEC REGULATIONS ISSUED UNDER TITLE 10, CODE OF FEDERAL REGULATIONS. AEC REGULATIONS AND POLICIES FOR CONTROL OF EXPOSURES FROM RADIATION AND RADIOACTIVE MATERIALS ARE BASED PRIMARILY ON GUIDANCE PROMULGATED BY THE INTERNATIONAL COMMISSION ON RADIATION PROTECTION, THE NATIONAL COUNCIL ON RADIATION PROTECTION, AND THE FEDERAL RADIATION COUNCIL. CONDITIONS IN OPERATING LICENSES ISSUED BY THE AEC REQUIRE APPROPRIATE SURVEILLANCE AND MONITORING PROGRAMS AS A BASIS FOR DEMONSTRATING COMPLIANCE WITH AEC REGULATORY LIMITS FOR THE RELEASE OF RADIOACTIVE EFFLUENTS.

16-1-6-76 INCIDENT AT THE LUCENS REACTOR
MILLER, J. M.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
THE LUCENS 8.3-MW(E) EXPERIMENTAL NUCLEAR POWER STATION SUFFERED A LOSS OF CARBON DIOXIDE COOLANT AND DEUTERIUM OXIDE MODERATOR, AS WELL AS DAMAGE TO ONE OF ITS FUEL ELEMENTS, ON JAN. 21, 1969. THIS ARTICLE PRESENTS SOME OF THE PRELIMINARY RESULTS OF THE INVESTIGATION AS TO THE CAUSE OF THE INCIDENT. THE FINAL RESULTS HAVE NOT BEEN PUBLISHED.

16-1-6-79 IAEA SYMPOSIUM ON EXPERIENCE FROM OPERATING AND FUELING OF NUCLEAR POWER PLANTS
PRYOR, W. A.
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, OAK RIDGE, TENN.
A SYMPOSIUM ON EXPERIENCE FROM OPERATING AND FUELING OF NUCLEAR POWER PLANTS WAS HELD OCT. 8-12, 1973, AT THE INTERNATIONAL ATOMIC ENERGY AGENCY IN VIENNA. THERE WERE 188 PARTICIPANTS FROM 35 COUNTRIES AND 4 INTERNATIONAL ORGANIZATIONS, AND 45 PAPERS WERE PRESENTED. IN ADDITION TO THE FOUR SESSIONS DEVOTED TO REVIEWS OF GENERAL OPERATING EXPERIENCE, THE MEETING INCLUDED SESSIONS ON BEHAVIOR OF MAJOR COMPONENTS, WASTE MANAGEMENT SYSTEMS, FUELING EXPERIENCE, TESTING, AND PERSONNEL TRAINING. THIS ARTICLE REVIEWS THE EXPERIENCES DESCRIBED IN THE FORMAL PAPERS AND IN THE PANEL DISCUSSION.

16-2-1-127 QUALITY ASSURANCE IN THE CONSTRUCTION OF NUCLEAR POWER PLANTS
BERNSEN, S. A.
BECHTEL POWER CORPORATION, SAN FRANCISCO, CALIF.
THIS ARTICLE IS A GENERAL SURVEY OF QUALITY ASSURANCE (QA) PRACTICES AS THEY RELATE TO THE CONSTRUCTION PHASE OF NUCLEAR POWER PLANTS. THE ARTICLE BRIEFLY OUTLINES THE EVOLUTION OF CONSTRUCTION QA REQUIREMENTS, DESCRIBES CONSTRUCTION PRACTICES AND ORGANIZATIONAL RELATIONS THAT HELP IDENTIFY THE UNIQUE CONSTRUCTION PHASE FEATURES THAT AFFECT QA PRACTICES, IDENTIFIES SOME OF THE PRINCIPAL REQUIREMENTS AND PROGRAMMATIC PROBLEMS INVOLVING CONSTRUCTION, AND DISCUSSES POTENTIAL TRENDS AND SUGGESTED GUIDELINES FOR THE IMPLEMENTATION OF PARTICULAR PRACTICES.

16-2-1-141 1974 ANS TOPICAL MEETING ON FAST REACTOR SAFETY
FONTANA, M. H.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE IS A BRIEF REVIEW OF THE AMERICAN NUCLEAR SOCIETY TOPICAL MEETING ON FAST REACTOR SAFETY, HELD AT BEVERLY HILLS, CALIF., APR. 2-4, 1974, SPONSORED BY THE TECHNICAL GROUP ON REACTOR SAFETY AND THE LOS ANGELES SECTION OF THE AMERICAN NUCLEAR SOCIETY. PRESENTATIONS AND DISCUSSIONS ON SAFETY PHILOSOPHY, RESEARCH NEEDS, AND SAFETY PHENOMENOLOGY INDICATE STEADY PROGRESS TOWARD UNDERSTANDING THE TECHNICAL BASES OF FAST REACTOR SAFETY, ALTHOUGH DIFFERENCES OF OPINION APPEAR TO EXIST WITH RESPECT TO PHILOSOPHY OF APPLICATION TO REACTOR DESIGNS.

16-2-3-150 GBR-4 PROTECTION SYSTEMS - FAILURES AND THEIR CONSEQUENCES
BURGSMULLER, P. + DEKAIS, J. J. + KRAHE, A.
PIGNATELLI, R. + VIEIDER, G.
GAS BREEDER REACTOR ASSOCIATION, BRUSSELS, BELGIUM
IN THE GBR-4 DESIGN OF A GAS COOLED FAST BREEDER REACTOR, EMPHASIS IS PLACED ON USING TO ADVANTAGE THE SINGLE PHASE CHARACTER OF THE COOLANT. SPECIFIC FEATURES OF THE PROTECTIVE SYSTEMS ARE FAIL-SAFE NEUTRON ABSORPTION, PERMANENTLY OPERATING AUXILIARY SUPPLIES, AND ATMOSPHERIC PRESSURE COOLING. A COMPUTER PROGRAM THAT USES A POINT REACTOR MODEL FOR HEAT TRANSFER AND NEUTRON KINETICS IS USED FOR TRANSIENT ANALYSIS, AND A STEAM GENERATOR DYNAMICS CODE IS USED TO DESCRIBE SECONDARY SIDE EFFECTS. ANTICIPATED DISTURBANCES IN OPERATION ARE REACTIVITY INSERTION, LOSS OF SUPPLIES, AND LOSS OF COOLANT PRESSURE. FAILURES IN REACTOR PROTECTION SYSTEMS ARE POSTULATED FOR THESE DISTURBANCES IN DECREASING ORDER OF PROBABILITY, AND THE CONSEQUENCES ARE ANALYZED AND DISCUSSED. THE RESULTS LEAD TO THE CONCLUSION THAT, OWING TO THE INHERENT CHARACTERISTICS OF THE SYSTEM AND TO THE SPECIFIC DESIGN, OCCURRENCES ARE WELL WITHIN THE LIMITS OF A TYPICAL PROBABILITY RELEASE CRITERION.

16-2-3-162 STANDBY EMERGENCY POWER SYSTEMS. II. THE LATER PLANTS
HAGEN, E. W.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS IS THE SECOND PART OF A TWO-PART ARTICLE THAT REVIEWS THE STANDBY EMERGENCY ELECTRIC POWER SYSTEMS FOR COMMERCIAL NUCLEAR POWER PLANTS. PART 1 APPEARED IN THE 14(3) ISSUE OF NUCLEAR SAFETY AND DISCUSSED THESE SYSTEMS AS THEY APPLIED TO THE EARLY PLANTS. PART 2, THE LATER PLANTS, UPDATES THE DESIGN CRITERIA AND CONSIDERATIONS SET FORTH IN PART 1 AND OFFERS SOME SUGGESTIONS FOR IMPROVING RELIABILITY AND AVAILABILITY FOR THESE SYSTEMS. TODAY, EVEN WITHIN THE CONFINES OF A SINGLE LARGE UTILITY, THE SYSTEM DESIGNS VARY BECAUSE OF THE DIFFERENT ARCHITECT ENGINEERS INVOLVED WITH THE VARIOUS PLANTS, PLANT CHARACTERISTICS VARY FROM SITE TO SITE, AND EVEN CONCEPTS CHANGE WITH TIME WITHIN A GIVEN DESIGN GROUP. SOME OF THE DESIGN PROBLEMS AND OPERATING EXPERIENCES FOR THE FOLLOW-ON PLANTS ARE EXEMPLIFIED. QUALITY ASSURANCE PROCEDURES ARE MENTIONED, AND SOME CONSIDERATIONS CONCERNING RELIABILITY, WHICH HAS NOT CHANGED SIGNIFICANTLY FOR THE LATER PLANTS, ARE DISCUSSED. SINCE HIGH AVAILABILITY OF THE STANDBY EMERGENCY ELECTRIC POWER SYSTEMS APPEARS TO BE THE MORE ATTAINABLE CHARACTERISTIC TO STRIVE FOR, SOME METHODS FOR ACHIEVING THIS ARE PROFFERED.

16-2-4-190 RADIOTOXIC HAZARD MEASURE FOR BURIED SOLID RADIOACTIVE WASTE
HAMSTRA, J.
REACTOR CENTRUM NEDERLAND, THE HAGUE, NETHERLANDS
THIS ARTICLE REVIEWS THE RADIOTOXIC HAZARDS RESULTING FROM THE DISPOSAL OF HIGH LEVEL REPROCESSING WASTES INTO A DEEP GEOLOGICAL FORMATION. THE TERM RADIOTOXIC HAZARD MEASURE (RHM), USED TO MEASURE THE HAZARD FROM BURIED RADIOACTIVE WASTES, IS BASED ON THE MAXIMUM RADIONUCLIDE CONCENTRATION PERMISSIBLE IN WATER. CALCULATIONS ARE MADE OF THE RHM LEVELS FOR THE HIGH LEVEL REPROCESSING WASTES OF BOTH LIGHT WATER REACTOR AND FAST BREEDER REACTOR FUELS. IN COMPARING THESE RHM LEVELS WITH THAT FOR THE NATURAL ACTIVITY OF AN EQUIVALENT AMOUNT OF URANIUM ORE AND ITS MILL TAILINGS, IT IS CONCLUDED THAT AN ACTUAL ADDITIONAL RADIOTOXIC HAZARD FOR BURIED HIGH LEVEL REPROCESSING WASTE ONLY EXISTS FOR THE FIRST 300 TO 500 YEARS AFTER BURIAL.

16-2-4-190 THE THIRTEENTH AEC AIR CLEANING CONFERENCE
MOELLER, D. W. + UNDERHILL, C. W. + FIRST, M. W.
HARVARD UNIVERSITY, CAMBRIDGE, MASS.
THE THIRTEENTH AEC AIR CLEANING CONFERENCE WAS HELD AUG. 12-15, 1975, IN SAN FRANCISCO, CALIF. A TOTAL OF 374 PEOPLE REGISTERED, INCLUDING PERSONNEL FROM ESSENTIALLY ALL FACETS OF INDUSTRY, GOVERNMENTAL AGENCIES, AND EDUCATIONAL INSTITUTIONS, PLUS REPRESENTATIVES FROM NINE FOREIGN COUNTRIES. MAJOR TOPICS WERE 1) PERFORMANCE AND RELIABILITY OF AIR CLEANING SYSTEMS 2) ADSORPTION, CONCENTRATION, AND STORAGE OF RADIOACTIVE NOBLE GASES 3) DESIGN, CONSTRUCTION, AND OPERATION OF REACTOR OFF-GAS TREATMENT SYSTEMS 4) DESIGN, TESTING, AND OPERATION OF VENTILATION SYSTEMS FOR REACTORS 5) PLUTONIUM HANDLING FACILITIES, AND FUEL REPROCESSING OPERATIONS 6) SAMPLING AND MONITORING OF AIRBORNE RELEASES, AND 7) CONTROL OF FIRES AND EXPLOSIONS. SUPPLEMENTARY SESSIONS COVERED SPECIAL PROBLEMS ASSOCIATED WITH MANAGING RADIOIODINE AND TRITIUM. A MAJOR DEFICIENCY BROUGHT OUT AT THE CONFERENCE WAS THE CONTINUED LACK OF ATTENTION BEING GIVEN TO AIR CLEANING SYSTEMS, PARTICULARLY IN THE PLANNING STAGES OF NUCLEAR FACILITIES. THERE IS A SIMILAR LACK OF ATTENTION TO THE NEEDS OF THOSE RESPONSIBLE FOR PREOPERATIONAL AND POSTOPERATIONAL TESTING OF SUCH SYSTEMS AFTER INSTALLATION. ON THE POSITIVE SIDE, THE CONFERENCE REVEALED THAT PROGRESS IS BEING MADE ON DEVELOPING PROCESSES FOR TRITIUM REMOVAL, ON CONCENTRATION AND STORAGE PROCEDURES FOR THE NOBLE GASES, AND ON METHODS FOR HANDLING AIR CLEANING PROBLEMS OF HIGH TEMPERATURE GAS COOLED REACTORS AND LIQUID METAL COOLED FAST BREEDER REACTORS. A MODEST EFFORT IS ALSO BEING DIRECTED TO THE POTENTIAL AIR CLEANING PROBLEMS ASSOCIATED WITH NUCLEAR FUSION.

16-2-5-204 ENVIRONMENTAL RADIATION EFFECTS OF NUCLEAR FACILITIES IN NEW YORK STATE
TERPILAK, M. S. + JORGENSEN, D. E.
ENVIRONMENTAL PROTECTION AGENCY, NEW YORK CITY, N. Y.
THE ANNUAL QUANTITIES AND TYPES OF RADIOACTIVE MATERIALS RELEASED FROM THREE OPERATING NUCLEAR ELECTRIC GENERATING FACILITIES AND A NUCLEAR FUELS REPROCESSING FACILITY ARE PRESENTED AND DISCUSSED. THE PERIOD OF INTEREST SPANS THE YEARS 1969 TO 1972 WITH SOME ADDITIONAL DATA FOR THOSE FACILITIES OPERATING BEFORE 1969. RELEASE QUANTITIES HAVE BEEN WELL CONTROLLED. CONSIDERING THE NATURE AND VINTAGE OF THE OPERATIONS. PRESENTED ARE THE RESULTS OF ENVIRONMENTAL SURVEILLANCE RELYING MOST HEAVILY ON THE ACTIVITIES OF THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION. OBSERVATIONS AT INDIAN POINT 1 AND AT NUCLEAR FUEL SERVICES, INC., HAVE LED TO THE DISCOVERY OF SEVERAL FACILITY RELATED RADIOISOTOPES IN ENVIRONMENTAL MEDIA. THESE TWO FACILITIES ARE OF COMPARATIVELY EARLY VINTAGE, HAVE PRODUCED SLIGHTLY LARGER AMOUNTS OF WASTE MATERIALS, AND HAVE BEEN THE SUBJECT OF MORE COMPREHENSIVE STUDIES THAN OTHERS IN THE STATE. DOSE CONSEQUENCES TO HYPOTHETICAL PERSONS AND TO POPULATIONS WITHIN 50 MILES OF THE FACILITIES ARE ADDRESSED. IT SHOULD BE STRESSED THAT ALL INDIVIDUAL DOSES PRESENTED ARE HYPOTHETICAL. DOSES VIA THE DRINKING WATER AND COWS MILK PATHWAYS ARE PARTICULARLY CONSERVATIVE. IN EACH CASE THESE HYPOTHETICAL DOSES ARE AT LEAST AN ORDER OF MAGNITUDE OR MORE GREATER THAN THE KNOWN WORST CASE. NO EXCESSIVE EXPOSURE LEVELS ARE KNOWN TO HAVE EXISTED. ALL OPERATIONS HAVE RESULTED IN POSTULATED EXPOSURE LEVELS WELL WITHIN APPLICABLE REGULATIONS OR GUIDELINES, GENERALLY BEING A SMALL PERCENTAGE OF THESE VALUES. POPULATION DOSES HAVE BEEN SURPRISINGLY CONSISTENT THROUGH THE PERIOD OF INTEREST. THEY ARE INSIGNIFICANT IN COMPARISON TO THE DOSE TO THE POPULATION OF THE STATE FROM NATURAL OR MEDICAL SOURCES.

16-2-6-223 SET-POINT DRIFT IN NUCLEAR POWER PLANT SAFETY RELATED INSTRUMENTATION
NUCLEAR SAFETY STAFF
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
FROM JAN.1972, TO JUNE30,1973, 222 INSTANCES OF SET-POINT DRIFT IN NUCLEAR POWER PLANT PROTECTIVE INSTRUMENTATION DEVICES WERE REPORTED AS ABNORMAL OCCURRENCES BY NUCLEAR POWER PLANT LICENSEES. THIS ARTICLE PRESENTS THE RESULTS OF A STUDY PERFORMED TO ASSESS THE CAUSES AND SIGNIFICANCE OF THESE INCIDENTS.

16-2-6-224 DIESEL GENERATOR OPERATING EXPERIENCE AT NUCLEAR POWER PLANTS
CROOKS, J. L. + VISSING, G. S.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
AVAILABLE TEST AND OPERATING EXPERIENCE DATA ARE PROVIDED FOR DIESEL GENERATOR UNITS INSTALLED AS STANDBY ELECTRIC POWER SUPPLIES IN OPERATING NUCLEAR POWER PLANTS. THE DATA INCLUDE FAILURES EXPERIENCED DURING PERIODIC SURVEILLANCE TESTS AND DURING ABNORMAL EVENTS IN WHICH THE STANDBY POWER SYSTEM WAS REQUIRED TO OPERATE AUTOMATICALLY. THE DIESEL GENERATOR FAILURES EXPERIENCED DURING SURVEILLANCE TESTING OF THE UNITS ARE TABULATED FOR EACH OPERATING NUCLEAR PLANT AND ARE CLASSIFIED BY MANUFACTURER, BY THE ELECTRICAL CAPACITY OR SIZE OF THE DIESEL-GENERATOR UNIT, AND BY THE COMPONENT OR SUBSYSTEM INITIATING THE FAILURE. THE PROBABILITY OF SUCCESSFUL PERFORMANCE COMPUTED FROM THESE SURVEILLANCE TEST DATA IS LESS THAN 0.95 AT A CONFIDENCE LEVEL OF 50 PERCENT FOR MOST UNITS.

16-3-1-273 REVIEW OF ANS TOPICAL MEETING ON NUCLEAR POWER PLANT SITING
PEELLE, E. + BAUMAN, H.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
THE AMERICAN NUCLEAR SOCIETY TOPICAL MEETING ON NUCLEAR POWER PLANT SITING, HELD IN PORTLAND, OREG., AUG. 25-28, 1974, INCLUDED SESSIONS DEVOTED TO THE GOVERNMENT AND SITING, METHODOLOGIES OF SITE SELECTION, SPECIAL AND TECHNICAL ISSUES, UTILITY SITING EXPERIENCE, AND SOCIAL AND PUBLIC ACCEPTANCE ISSUES. HIGHLIGHTS OF THE MEETING INCLUDED SPEECHES BY AEC CHAIRMAN DIXY LEE RAY, MICHAEL MCCLOSKEY OF THE SIERRA CLUB, AND SAUL LEVINE OF THE AEC PROBABILISTIC RISK STUDY TEAM. UTILITIES' PROBLEMS AND PRACTICES IN SITING NUCLEAR POWER PLANTS WERE DISCUSSED BY FOUR AMERICAN, AS WELL AS REPRESENTATIVES OF FRENCH AND SWISS, UTILITIES. THE LACK OF WHOLLY SUITABLE SITES AND CONCERN WITH PUBLIC ACCEPTANCE WERE COMMON THEMES ADDRESSED IN WIDELY DIFFERENT MANNERS. INSTITUTIONAL CHANGES IN SITING PROCEDURES AND APPROACHES WERE SUGGESTED IN BOTH THE FIRST SESSION ON GOVERNMENTAL ROLES AND THE FINAL SESSION ON SOCIAL ISSUES.

16-3-1-282 NUCLEAR ENERGY CENTERS - A PRIME ELEMENT IN REACTOR SITING
COPE, D. F.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN. + FEDERAL ENERGY ADMINISTRATION, WASHINGTON, D. C.
MEETING THE NATION'S FUTURE ENERGY REQUIREMENTS PORTENDS A MAJOR ROLE FOR NUCLEAR POWER. THIS COULD RESULT IN HUNDREDS OF RELATIVELY SMALL, DISPERSED NUCLEAR SITES THROUGHOUT THE COUNTRY BY THE YEAR 2000 IF PRESENT SITING TRENDS WERE TO CONTINUE. THE SITING OF SEVERAL NUCLEAR REACTORS AND THEIR ASSOCIATED FACILITIES IN A SMALL NUMBER OF CONCENTRATED NUCLEAR ENERGY CENTERS IS AN ALTERNATIVE HAVING MANY ADVANTAGES. THIS ARTICLE DESCRIBES THE BACKGROUND OF THE IDEA AND DISCUSSES SOME

OF THE ADVANTAGES AND PROBLEMS IN CLUSTERING NUCLEAR REACTORS INTO NUCLEAR ENERGY CENTERS. IT CONCLUDES THAT THERE ARE COMPELLING ARGUMENTS FOR THE RATIONAL DEPLOYMENT OF NUCLEAR ENERGY, PARTICULARLY BREEDER REACTORS, INTO SUCH CENTERS BUT NOTES THAT THERE ARE MANY UNRESOLVED ISSUES ON WHICH MUCH WORK MUST BE DONE BEFORE FINAL ANSWERS ARE AVAILABLE AS TO THE SIZE, COMPOSITION, AND EXTENT TO WHICH THE ENERGY CENTER CONCEPT CAN BE APPLIED.

16-3-2-291 PIN-TO-PIN FAILURE PROPAGATION IN LIQUID METAL COOLED FAST BREEDER REACTOR FUEL SUBASSEMBLIES
VAN ERP, J. B. + CHANLA, T. L. + WILSON, R. E.
FAUSKE, H. K.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILL.
THIS ARTICLE IS A REVIEW OF RECENT EXPERIMENTAL AND ANALYTICAL WORK PERFORMED WITH THE OBJECTIVE OF EVALUATING THE POTENTIAL FOR PIN-TO-PIN FAILURE PROPAGATION WITHIN FUEL SUBASSEMBLIES OF LIQUID METAL COOLED FAST BREEDER REACTORS (LMFBRS) OF CURRENT DESIGN. IT IS CONCLUDED THAT (1) PIN-TO-PIN FUEL-FAILURE PROPAGATION FOR CURRENT LMFBR DESIGNS IS UNLIKELY, AND (2) IF FAILURE PROPAGATION OCCURS AT ALL, IT WILL BE SELF-LIMITING OR ITS PROGRESSION WILL BE SLOW, THUS ALLOWING AMPLE TIME FOR DETECTION AND CORRECTIVE ACTION IF APPROPRIATE INSTRUMENT SYSTEMS ARE PROVIDED.

16-3-3-308 THE 1974 SPECIALISTS MEETING ON REACTOR NOISE
THIE, J. A.
CONSULTANT, BARRINGTON, ILL.
AN INTERNATIONAL MEETING OF SPECIALISTS ON REACTOR NOISE WAS HELD IN ROME, ITALY, OCT. 21-25, 1974. THEORETICAL AND EXPERIMENTAL PAPERS TREATED BOTH ZERO POWER AND POWER REACTORS FOR ALL MAJOR REACTOR TYPES. SIXTEEN DIFFERENT CATEGORIES OF NOISE-ANALYSIS PRACTICAL APPLICATIONS, MOSTLY IN POWER REACTORS, WERE IDENTIFIED FROM THE 46 PAPERS PRESENTED. ABOUT A THIRD OF THESE CATEGORIES ARE NEW SINCE THE LAST INTERNATIONAL CONFERENCE ON NOISE WAS HELD IN 1968. A DEPTH OF UNDERSTANDING OF ZERO POWER NOISE WAS EXHIBITED, AND IN A FEW OF THE MANY CATEGORIES OF POWER REACTOR NOISE, GOOD EXPERIMENTAL AND THEORETICAL UNDERSTANDINGS WERE PROJECTED.

16-3-3-316 QUANTIFICATION OF MAN - MACHINE SYSTEM RELIABILITY IN PROCESS CONTROL
FRANK P. LEES
LOUGHBOROUGH UNIVERSITY OF TECHNOLOGY, ENGLAND
AUTHORITATIVE DISCOURSES ON THE SUBJECT OF HUMAN RELIABILITY IN CONTROL SYSTEMS ARE AVAILABLE IN JOURNALS DEVOTED TO ERGONOMICS, CYBERNETICS, AND HUMAN FACTORS. HOWEVER, THE SUBJECT IS ALSO OF PRIME INTEREST TO OPERATIONS IN THE NUCLEAR INDUSTRY. THEREFORE AN OVERVIEW OF THE SUBJECT OF OPERATOR RELIABILITY IS PRESENTED BY BOTH A DIGEST OF A PREVIOUSLY PUBLISHED PAPER AND AN ADDED SHORT BIBLIOGRAPHY.

16-3-4-318 RADIONUCLIDE BEHAVIOR DURING NORMAL OPERATION OF LIQUID METAL COOLED FAST BREEDER REACTORS II. TRANSPORT
CHOMAN, C. A. + KELLY, J. L. + REYNOLDS, A. B.
UNIVERSITY OF VIRGINIA, CHARLOTTESVILLE, VA.
THIS IS THE SECOND PART OF A TWO PART ARTICLE ON RADIONUCLIDE BEHAVIOR DURING NORMAL OPERATION OF A LIQUID-METAL-COOLED FAST BREEDER REACTOR (LMFBR). PART 1, INCLUDED IN NUCLEAR SAFETY 16(1), DISCUSSED THE PRODUCTION OF RADIOACTIVITY. PART 2 REVIEWS THE TRANSPORT OF THE VARIOUS RADIONUCLIDES. ALTHOUGH RELIANCE WAS PLACED ON PUBLISHED RESULTS FOR BOTH PARTS, SOME NEW CALCULATIONS WERE MADE WHERE NEEDED. RESULTS WERE NORMALIZED TO A 1000-MW(E) LMFBR AND COMPARED WITH VALUES FOR A LIGHT WATER REACTOR (LWR). THIS REVIEW INCLUDES THE TRANSPORT OF TRITIUM AND CORROSION PRODUCTS, TRANSPORT OF FISSION PRODUCTS FROM FAILED FUEL, BEHAVIOR OF RADIOACTIVITY IN SODIUM AND COLD TRAPS, AND OPERATION OF GASEOUS RADWASTE SYSTEMS. OPERATING EXPERIENCES ARE REVIEWED FOR THE FAST REACTORS EBR-II, FERMI, SEFOR, DOUNREAY, RAPSODIE, AND BR-5. LIMITED DATA ARE GIVEN FOR THE THERMAL REACTORS SRE, SBER, AND HALLAM.

16-3-5-337 KINETICS EQUATION FOR LINEAR FIRST-ORDER NUCLEAR PHENOMENA
SKRABLE, K. + FRENCH, C. + CHABOT, G. + MAJOR, A.
WARD, K.
LOWELL TECHNOLOGICAL INSTITUTE, LOWELL, MASS.
THIS ARTICLE DESCRIBES A GENERAL EQUATION FOR THE KINETICS OF SERIALLY RELATED QUANTITIES LINKED BY LINEAR FIRST-ORDER PRODUCTION AND DESTRUCTION PHENOMENA. THE EQUATION IS APPLICABLE TO SYSTEMS OF CONCERN IN NUCLEAR AND RADIOLOGICAL SCIENCES AND HEALTH PHYSICS. SUGGESTED APPLICATIONS INCLUDE (1) THE SERIAL TRANSFORMATION OF RADIONUCLIDES, (2) THE COLLECTION AND ANALYSIS OF SERIALLY RELATED AIRBORNE RADIOACTIVE PARTICULATES, (3) THE INVENTORY OF QUANTITIES IN THE CORE OF A NUCLEAR REACTOR, SUCH AS FISSION PRODUCTS, POISONS, FISSILE ELEMENTS, AND TRANSURANIUM ELEMENTS, (4) INTERNAL DOSIMETRY, SUCH AS THE BURDEN OF RADIONUCLIDES IN THE VARIOUS SEGMENTS OF THE GASTROINTESTINAL TRACT AND RESULTING DOSES FOR SINGLE OR CONTINUOUS INTAKES OF PARENT AS WELL AS DAUGHTER RADIONUCLIDES, (5) THE QUANTITY OF AIRBORNE RADIOACTIVE AEROSOLS GENERATED IN A VENTILATED SPACE THROUGH THE DECAY OF PARENT INERT RADIOACTIVE GASES, SUCH AS RADON, THORON, XENON, AND KRYPTON, AND (6) THE CALCULATION OF ROUTINE AND ACCIDENTAL RELEASES FROM NUCLEAR PLANTS.

16-3-5-345 THE ERDA RADIOLOGICAL ASSISTANCE PROGRAM
SMALLEY, W. L.
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, OAK RIDGE, TENN.
THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION (ERDA) RADIOLOGICAL ASSISTANCE PROGRAM PROVIDES ADVICE AND ASSISTANCE AT THE SCENE OF A RADIOLOGICAL INCIDENT WHEN ERDA BELIEVES THAT SUCH ACTION IS NECESSARY OR ON REQUEST FROM OTHER AGENCIES OR INDIVIDUALS. THIS ARTICLE DISCUSSES THE TYPES OF ASSISTANCE AVAILABLE AND MEANS OF OBTAINING THAT ASSISTANCE AND PROVIDES STATISTICS SUMMARIZING THE EXPERIENCE WITH THE PROGRAM ALONG WITH GUIDELINES FOR HANDLING RADIOLOGICAL EMERGENCIES.

16-3-6-434 STEAM-GENERATOR TUBE FAILURES - WORLD EXPERIENCE IN WATER COOLED NUCLEAR POWER REACTORS DURING 1972
STEVENS-GUILLE, P. D.
ATOMIC ENERGY OF CANADA LIMITED, CHALK RIVER, CANADA
DURING 1972, APPROXIMATELY ONE IN THREE OPERATING REACTORS WITH STEAM GENERATORS INCURRED TUBE FAILURES, PREDOMINANTLY NEAR THE TUBE SHEET AND IN THE BEND REGION. VARIOUS FORMS OF CORROSION WERE THE MOST FREQUENT CAUSE OF FAILURE. EDDY-CURRENT INSPECTION WAS THE PREFERRED METHOD FOR LOCATING AND INVESTIGATING THE CAUSE OF FAILURE. EXTENSIVE USE WAS MADE OF BOTH MECHANICAL AND EXPLOSIVE PLUGS FOR REPAIR. AS A CLASS, STEAM GENERATORS WITH MONEL 400 TUBES HAD THE LOWEST FAILURE RATES, AND THOSE WITH INCONEL 600 TUBES HAD THE HIGHEST.

16-4-1-415 THE ANSI-NSMB NUCLEAR STANDARDS PROGRAM
SAVOLAINEN, A. W.
AMERICAN NATIONAL STANDARDS INSTITUTE, NEW YORK, N.Y.
THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)-NUCLEAR STANDARDS MEASUREMENT BOARD (NSMB) NUCLEAR STANDARDS PROGRAM HAS, SINCE ITS INFANCY, PROCEEDED ON A BASE OF LONG TERM PLANS AND BROAD GOALS BEYOND THOSE OF THE INDIVIDUAL STANDARDS PROJECTS UNDERTAKEN. THE EFFORT IN THE DEVELOPMENT OF NUCLEAR STANDARDS HAS FOCUSED ON MANY OBJECTIVES, INCLUDING,(1) THE EXPEDITIOUS DEVELOPMENT OF HIGH QUALITY STANDARDS IN AREAS OF NEED,(2) MAXIMUM COORDINATION OF THE PROGRAM TO PROMOTE A DISCIPLINED ENGINEERING APPROACH TO DESIGN AND CONSTRUCTION OF NUCLEAR FACILITIES, TO ENSURE ADEQUATE AND SAFE PLANTS, AND TO PROVIDE UTILITY AND SAFETY IN THE USE OF RADIOACTIVE MATERIALS,(3) PARTICIPATION IN THE PROGRAM BY THOSE WHO WILL ULTIMATELY USE THE STANDARDS,(4) RELIEF OF VOLUNTEER PROFESSIONALS FROM ADMINISTRATIVE BURDENS THAT DO NOT UTILIZE THEIR TIME EFFECTIVELY,(5) INCREASED PARTICIPATION BY PROFESSIONAL STANDARDS WRITING ORGANIZATIONS. THE INFORMATIONAL TOOLS ARE NOW IN PLACE TO ASSIST STANDARDS WRITING GROUPS IN ORGANIZING AND COMPLETING THEIR TASKS, TO PROVIDE STANDARDS MANAGEMENT GROUPS WITH A BASIS FOR EVALUATING PROGRESS, AND TO AID PROGRAM PLANNERS IN ASSURING ACHIEVEMENT OF THEIR GOALS WITH A MINIMUM OF OVERLAP AND DUPLICATION. AS OF JANUARY 1975, APPROXIMATELY 1500 STANDARDS HAD BEEN IDENTIFIED AS HAVING NUCLEAR APPLICATION, AND THERE WERE 551 ACTIVE PROJECTS UNDER THE COGNIZANCE OF NSMB.

16-4-1-421 THE NEW FEDERAL WATER POLLUTION CONTROL ACT AND ITS IMPACT ON NUCLEAR POWER PLANTS PART II. THE EFFECT OF FWPCA ON NRC LICENSING JURISDICTION AND PROCEDURES
DAVIS, J. P.
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC., N.Y.
PART II OF THIS ARTICLE COVERS THE INTERRELATIONSHIP OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) AND THE U.S. NUCLEAR REGULATORY COMMISSION (NRC) ENVIRONMENTAL REVIEWS UNDER THE FEDERAL WATER POLLUTION CONTROL ACT (FWPCA) AND OTHER STATUTES. THE SCOPE OF EPA'S AUTHORITY TO REGULATE RADIOACTIVE MATERIALS DISCHARGE UNDER FWPCA AND THE IMPACT ON NRC REGULATION UNDER THE ATOMIC ENERGY ACT ARE DISCUSSED, AND THE EFFECT OF FWPCA ON NRC ENVIRONMENTAL JURISDICTION UNDER NEPA IS CONSIDERED. IN ADDITION, THE PROBLEMS INVOLVED IN POSSIBLE OVERLAPPING AGENCY JURISDICTIONS AND THE EPA-AEC MEMORANDA OF UNDERSTANDING ARE ANALYZED. THIS ARTICLE ALSO BRIEFLY SUMMARIZES EVENTS THAT HAVE OCCURRED SINCE THE PUBLICATION OF PART I. FINALLY, THE PROSPECTS FOR A WORKABLE DISCHARGE PERMIT SYSTEM UNDER THE FWPCA ARE DISCUSSED.

16-4-2-436 CSNI MEETING ON FUEL - COOLANT INTERACTIONS
FAUSKE, H. K.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILL.
THIS ARTICLE IS A BRIEF REVIEW OF THE SECOND SPECIALIST MEETING ON FUEL-COOLANT INTERACTIONS IN FAST REACTORS. THE MEETING, SPONSORED BY THE COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS (CSNI), WAS HELD IN ISPRA, ITALY, NOV. 21-23, 1973. EXPERIMENTAL DATA PRESENTED AT THE MEETING INCLUDED TESTS WITH BOTH SIMULANTS AND LIQUID METAL-COOLED FAST BREEDER REACTOR (LMFBR) MATERIALS. IN THE LATTER CATEGORY, OVER 100 INTERACTION TESTS WERE DISCUSSED, INCLUDING APPROXIMATELY 30 PROTOTYPIC INREACTOR TESTS. ALL THE TESTS INVOLVING LMFBR MATERIALS RESULTED IN VERY MILD INTERACTIONS, EXCEPT FOR A FEW CASES WHERE SMALL QUANTITIES OF LIQUID SODIUM WERE INJECTED INTO MOLTEN URANIUM DIOXIDE (LABORATORY TESTS). THE ENERGETIC INTERACTIONS WERE GENERALLY EXPLAINED BY ENTRAPMENT AND OVERHEATING OF THE LIQUID SODIUM, ALTHOUGH SIGNIFICANT DIFFERENCES IN DETAILS OF THE PROPOSED MECHANISMS EXISTED. SEVERAL VARIATIONS OF THE ORIGINAL CHO-PADILLA ACCIDENT ANALYSIS MODEL OF FUEL-COOLANT INTERACTION WERE ALSO PRESENTED.

HOWEVER, LACK OF UNDERSTANDING OF FRAGMENTATION, MIXING, AND HEAT TRANSFER PROCESSES HAS PREVENTED SUBSTANTIAL IMPROVEMENT OF THE MODEL AS ORIGINALLY PROPOSED. (FULL-COOLANT INTERACTIONS REFERRED TO IN THIS ARTICLE ARE PHYSICAL, NOT CHEMICAL.)

16-4-2-443 A METHOD OF CALCULATING TURBINE MISSILE STRIKE AND DAMAGE PROBABILITIES
SWAN, S. W. + MELEIS, M.
JECHTEL POWER CORPORATION, SAN FRANCISCO, CALIF.
THE SIMPLE INEXPENSIVE COMPUTER CODE DESCRIBED IS USED FOR CALCULATING THE PROBABILITY OF TURBINE MISSILE DAMAGE TO SYSTEMS REQUIRED FOR SAFE SHUTDOWN OF A NUCLEAR PLANT FOLLOWING A STRUCTURAL FAILURE IN THE TURBINE GENERATOR SYSTEM. THE CODE CALCULATES THE PROBABILITY THAT A TURBINE MISSILE WILL STRIKE THE CONCRETE STRUCTURE SURROUNDING A PLANT SYSTEM AND THE PROBABILITY OF DAMAGE TO THE SYSTEM. EXAMPLE CALCULATIONS ARE PRESENTED TO ILLUSTRATE THE VARIATION IN THE CALCULATED PROBABILITIES FOR DIFFERENT PLANT ARRANGEMENTS AND DIFFERENT TARGET WALL THICKNESSES.

16-4-3-452 SENSITIVITY OF PORTABLE BETA-GAMMA SURVEY INSTRUMENTS
SOMMERS, J. F.
IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO FALLS, IDAHO
DEVELOPMENT OF A NEW GENERATION OF PORTABLE RADIATION SURVEY INSTRUMENTS AND APPLICATION OF THE "AS LOW AS PRACTICABLE" (ALAP) PHILOSOPHY HAVE PRESENTED A PROBLEM OF COMPLIANCE WITH GUIDES FOR RADIOACTIVE CONTAMINATION CONTROL. ISOLATED, LOW-LEVEL, DISCRETE PARTICLE BETA-GAMMA CONTAMINATION IS BEING DETECTED WITH THE NEW INSTRUMENTS. TO DETERMINE THE LIMITS OF PRACTICABILITY REQUIRES, IN TURN, THE DETERMINATION OF THE LIMITS OF DETECTION OF THESE SURFACE CONTAMINANTS. THE DATA AND CALCULATIONS INCLUDED IN THIS ARTICLE INDICATE THE SOURCE DETECTION FREQUENCIES THAT CAN BE EXPECTED USING THE NEW GENERATION OF SURVEY INSTRUMENTS. THE AUTHOR CONCLUDES THAT, IN LOW POPULATION GROUPS OF DISCRETE PARTICLES, ABOUT 5000 DIS/MIN OF BETA ACTIVITY PER PARTICLE IS THE MINIMUM LEVEL OF ACTIVITY PER PARTICLE WHICH IS APPLICABLE FOR CONFIDENT COMPLIANCE WITH SURFACE CONTAMINATION CONTROL GUIDES. LOWER CONTROL LEVELS ARE POSSIBLE WITH ADDITIONAL DEVELOPMENT OF INSTRUMENTS OR THROUGH HIGH COST CHANGES IN RADIATION SURVEY AND CONTAMINATION-CONTROL METHODS. ADDITIONAL ANALYSES ARE REQUIRED FOR ASSESSMENT OF THE HAZARD CAUSED BY WIDELY DISPERSED DISCRETE PARTICLE CONTAMINANTS.

16-4-4-458 APPLICATION OF EVAPORATION TO THE TREATMENT OF LIQUIDS IN THE NUCLEAR INDUSTRY
GOGUEE, H. W. + KIBBEY, A. H.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
A SURVEY OF EVAPORATION AS APPLIED TO RADIOACTIVE-WASTE SOLUTIONS SHOWED THAT SYSTEM DECONTAMINATION FACTORS (DFS) OF 10(3) TO 10(4) CAN BE EXPECTED FOR NONVOLATILE RADIOACTIVE CONTAMINANTS TREATED IN SINGLE STAGE EVAPORATORS. THE DF'S FOR IODINE CAN BE EXPECTED TO BE A FACTOR OF 10 TO 100 LOWER THAN THOSE EXPECTED FOR NONVOLATILE SPECIES UNDER ALKALINE, BUT NOT OXIDIZING OR ACIDIC, CONDITIONS. THE DF IS REDUCED BY A FACTOR OF ABOUT 10 IF ORGANIC MATERIALS ARE MIXED WITH AQUEOUS WASTES. THESE VALUES CONSIDER THAT THE EVAPORATOR IS WELL DESIGNED, ADEQUATELY SIZED, AND OPERATED WITH REASONABLE SKILL.

16-4-4-469 PROBLEMS IN NUCLEAR AIR CLEANING SYSTEMS
MOELLER, D. W.
HARVARD UNIVERSITY, BOSTON, MASS.
THIS ARTICLE IS A REVIEW OF PUBLISHED REPORTS OF FAILURES IN AIR CLEANING AND AIRBORNE WASTE MANAGEMENT SYSTEMS AT NUCLEAR INSTALLATIONS FROM 1966 TO 1974. THE REVIEW INDICATES INSTANCES OF DISRUPTION OF NOBLE GAS ADSORPTION SYSTEMS DUE TO HYDROGEN EXPLOSIONS, DECREASED PERFORMANCE OF PARTICULATE FILTERS DUE TO THE PRESENCE OF CONTAMINANTS OR THE FAILURE OF SEALS, DAMPERS, AND VALVES, AND IMPROPER EVALUATION OF THE EFFICIENCY OF AIR CLEANING SYSTEMS DUE TO SAMPLING AND OTHER PROCEDURAL ERRORS. ALTHOUGH A PORTION OF THE REPORTED FAILURES CAN BE ATTRIBUTED TO MANUFACTURING AND DESIGN DEFECTS, A MAJOR SHARE (ABOUT 65 PERCENT) APPEARS TO BE DUE TO ERRORS BY THOSE RESPONSIBLE FOR THE OPERATION AND MAINTENANCE OF AIR CLEANING EQUIPMENT.

16-4-5-482 REACTOR OPERATOR TRAINING PROGRAMS UTILIZING NUCLEAR POWER PLANT SIMULATORS
COLLINS, P. F.
U.S. ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
THE NUCLEAR REGULATORY COMMISSION (NRC) REQUIRES THAT ALL OPERATORS OF THE CONTROLS OF NUCLEAR FACILITIES BE LICENSED. APPLICANTS FOR LICENSES MUST PASS WRITTEN EXAMINATIONS AND OPERATING TESTS ADMINISTERED BY NRC. SOME INDIVIDUALS MUST BE EXAMINED PRIOR TO INITIAL CRITICALITY AT A FACILITY, WHEREAS OTHERS MUST HAVE HAD EXTENSIVE ACTUAL OPERATING EXPERIENCE AT A COMPARABLE REACTOR TO SIT FOR THESE EXAMINATIONS. OPERATING EXPERIENCE MAY BE OBTAINED THROUGH APPROVED TRAINING PROGRAMS THAT UTILIZE NUCLEAR POWER PLANT SIMULATORS. SINCE 1969, NRC'S PREDECESSOR, THE USAEC, HAS ACCEPTED FOUR SUCH TRAINING PROGRAMS THAT ARE ADMINISTERED BY THE VENDORS OF NUCLEAR POWER PLANT SYSTEMS. THE PROGRAMS CONSIST OF (1) NUCLEAR FUNDAMENTALS COURSES, (2) RESEARCH-REACTOR OPERATION, (3) LECTURES ON NUCLEAR POWER-PLANT DESIGN, (4) OBSERVATION AT OPERATING NUCLEAR POWER PLANTS, AND (5) SIMULATOR OPERATIONS. INDIVIDUALS

SEEKING LICENSES AFTER PLANTS BECOME OPERATIONAL MUST DEMONSTRATE THEIR PROFICIENCY AT REACTOR CONTROLS DURING EXAMINATIONS. IN 1971, THE USAEC APPROVED THE USE OF SIMULATORS IN TRAINING PROGRAMS AND DURING THE EXAMINATIONS. THESE PROGRAMS ARE LIMITED TO PERSONNEL FROM FACILITIES HAVING CONTROL ROOMS WHICH ARE CLOSELY PARALLEL TO THAT OF THE SIMULATOR. THE NRC ALSO REQUIRES LICENSED INDIVIDUALS TO PARTICIPATE IN REQUALIFICATION PROGRAMS THAT REQUIRE LICENSEES TO MANIPULATE REACTOR CONTROLS THROUGH A SPECIFIED NUMBER OF EVOLUTIONS DURING THEIR LICENSE TENURES. IF THE SIMULATOR'S OPERATING CHARACTERISTICS AND CONTROL ROOM ARE SIMILAR TO THOSE OF THE FACILITY INVOLVED, MANIPULATION OF SIMULATOR CONTROLS IS PERMITTED SO THAT THE NUMBER OF PLANT EVOLUTIONS SOLELY FOR REQUALIFICATION CAN BE MINIMIZED. FINAL EVALUATION OF THE MERITS OF USING SIMULATORS RATHER THAN OPERATING PLANTS IS BASED ON THE KNOWLEDGE AND UNDERSTANDING EXHIBITED BY TRAINEES DURING THE ADMINISTRATION OF EXAMINATIONS. THE NRC EXAMINERS HAVE FOUND THAT INDIVIDUALS TRAINED USING SIMULATORS HAVE A BETTER UNDERSTANDING OF PLANT RESPONSES TO TRANSIENT CONDITIONS AND ABNORMAL SITUATIONS AND ALSO ARE MORE CONFIDENT IN ANSWERING QUESTIONS THAT REQUIRE PREDICTION OF PLANT RESPONSES TO POSTULATED SITUATIONS. ALSO, SIMULATORS ARE EXTREMELY EFFECTIVE FOR EXAMINING AND EVALUATING INDIVIDUALS. THE NRC BELIEVES THAT SIMULATORS, USED IN CONJUNCTION WITH COMPREHENSIVE TRAINING PROGRAMS, ARE EFFECTIVE TRAINING DEVICES AND INTENDS TO ENCOURAGE THEIR USE IN FUTURE TRAINING PROGRAMS.

16-5-1-537 NUCLEAR LIABILITY INSURANCE - A RESUME OF RECENT YEARS

MARRONE, J.

NUCLEAR ENERGY LIABILITY-PROPERTY INSURANCE ASSOCIATION, FARMINGTON, CONN.

THE NUCLEAR LIABILITY INSURANCE POOLS HAVE STEADILY INCREASED NUCLEAR LIABILITY INSURANCE AVAILABLE TO THE NUCLEAR INDUSTRY TO ITS PRESENT $125 MILLION, WHICH IS MORE THAN DOUBLE THE $60 MILLION FIRST PROVIDED IN 1957. THE INSURANCE POOLS ALSO PROVIDE AN ADDITIONAL $175 MILLION OF ALL-RISK PROPERTY INSURANCE TO PROTECT AGAINST LOSS OF PROPERTY AT A NUCLEAR FACILITY, FOR A TOTAL OF $300 MILLION. THIS AMOUNT OF LIABILITY AND PROPERTY INSURANCE AVAILABLE FOR NUCLEAR RISKS EXCEEDS THE COVERAGE THE INSURANCE INDUSTRY HAS AT RISK ANYWHERE ON A SINGLE UNIT OF RISK, THUS ATTESTING TO THE CONFIDENCE IN NUCLEAR SAFETY. THE EXTRAORDINARY SAFETY ACHIEVED AND RECORDED BY THE LOSS EXPERIENCE OF THE NUCLEAR POOLS IS DESCRIBED. THE INSURANCE POOLS HAVE PROPOSED A CHANGE IN THE PRICE-ANDERSON ACT WHICH WOULD PROVIDE SUBSTANTIAL ADDITIONAL SUMS OF NUCLEAR LIABILITY INSURANCE TO PROTECT THE PUBLIC AND WHICH IS LIKELY TO BE THE SUBJECT OF EXAMINATION BY CONGRESS DURING 1975. THE PROPOSAL, IF IMPLEMENTED, WILL GRADUALLY INCREASE THE PROTECTION AFFORDED TO THE PUBLIC AND VIRTUALLY ELIMINATE THE ROLE OF GOVERNMENT INDEMNITY.

16-5-1-542 AMERICAN PHYSICAL SOCIETY'S STUDY OF LIGHT WATER REACTOR SAFETY

(EDITORS NOTE - IN AUGUST 1974 THE U.S. ATOMIC ENERGY COMMISSION RELEASED FOR REVIEW AND COMMENT A DRAFT OF WASH-1400, 'REACTOR SAFETY STUDY-AN ASSESSMENT OF ACCIDENT RISKS IN U.S. COMMERCIAL NUCLEAR POWER PLANTS.' SEE NUCLEAR SAFETY, VOL. 15, NO. 6, PAGES 673-675 FOR A BRIEF SUMMARY OF THAT REPORT. THAT STUDY BY THE AEC IS THE MOST COMPREHENSIVE OF ITS KIND EVER UNDERTAKEN AND HAS SINCE BEEN EXTENSIVELY REVIEWED BY MANY INTERESTED PARTIES. THEIR COMMENTS ARE AVAILABLE AT THE NRC PUBLIC DOCUMENT ROOM. CONCURRENT WITH THE AEC REACTOR SAFETY STUDY, THE AMERICAN PHYSICAL SOCIETY (APS) DECIDED TO SPONSOR A STUDY OF REACTOR SAFETY BECAUSE IT WAS AN IMPORTANT AND CONTROVERSIAL SUBJECT WITH SUBSTANTIAL SCIENTIFIC AND TECHNOLOGICAL CONTENT. TOWARD THAT END THE APS STUDY WAS SUPPORTED BY THE NATIONAL SCIENCE FOUNDATION AND THE AEC. THE APS STUDY WAS UNDERTAKEN IN 1974-1975 BY A STUDY GROUP CONSISTING OF 12 PART-TIME PARTICIPANTS WITH VARIOUS LEVELS OF PRIOR EXPERIENCE IN THE REACTOR FIELD. ITS PURPOSE WAS TO MAKE A QUANTITATIVE ESTIMATE OF THE LIKELIHOOD OF ACCIDENT CONSEQUENCES OF A GIVEN SEVERITY. ALTHOUGH THE APS STUDY GROUP DID NOT UNDERTAKE TO REVIEW THE AEC REACTOR SAFETY STUDY, THERE IS MUCH COMMON GROUND BETWEEN THE TWO, AND THE AEC STUDY IS MENTIONED FREQUENTLY IN THE APS REPORT. THE DRAFT OF THE APS REPORT, ENTITLED 'REPORT TO THE AMERICAN PHYSICAL SOCIETY BY THE STUDY GROUP ON LIGHT WATER-REACTOR SAFETY,' WAS RELEASED IN APRIL 1975, AND THE FINAL VERSION WILL BE PUBLISHED IN THE REVIEWS OF MODERN PHYSICS. BECAUSE OF THE IMPORTANCE OF THE SUBJECT AND BECAUSE OF THE TECHNICAL COMPETENCE AND OBJECTIVITY OF THE APS STUDY GROUP, THE EDITORS OF NUCLEAR SAFETY ARE HERE REPRINTING THE FIRST CHAPTER, 'SUMMARY OF CONCLUSIONS AND MAJOR RECOMMENDATIONS,' OF THE DRAFT OF THE APS REPORT.)

16-5-2-546 POTENTIAL EFFECTS AND CONSEQUENCES OF POSTULATED NEUTRONIC ACCIDENTS IN HTGRS

TOBIAS, M.

HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.

STUDIES OF POSTULATED NEUTRONIC EVENTS OF MAJOR CONCERN IN HIGH TEMPERATURE GAS COOLED REACTORS (HTGRS) ARE REVIEWED. THE LITERATURE COVERED INCLUDES LICENSING REVIEWS, SAFETY ANALYSIS REPORTS, AND TOPICAL REPORTS PREPARED DURING THE DESIGN AND DEVELOPMENT OF THE MAJOR REACTORS OF THE GENERAL ATOMIC

COMPANY. INCIDENTS CONSIDERED ARE LOSS OF FISSION PRODUCTS, CORE COMPRESSION DUE TO EARTHQUAKE, FUEL INSERTION DURING RELOADING, AND STEAM INTRODUCTION INTO THE CORE, ALL OF WHICH ARE JUDGED TO BE OF LESS IMPORTANCE THAN THE WITHDRAWAL OF A SINGLE ROD PAIR. INCIDENTS SUCH AS MULTIPLE ROD WITHDRAWAL OR ROD EJECTION HAVE BEEN DISMISSED AS PHYSICALLY IMPOSSIBLE. ANALYSES OF REACTIVITY CHANGES FOLLOWING A LOSS OF COOLANT ACCIDENT INDICATE THAT HTGRS WILL REMAIN SUBCRITICAL. OTHER ITEMS THAT CONTINUE TO RECEIVE ATTENTION ARE THE REACTIVITY CONSEQUENCES OF CORE SUPPORT COLLAPSE RESULTING FROM WEAKENING BY SEISMIC EVENTS OR STEAM CORROSION. THE PHYSICS CALCULATIONS HAVE BEEN EXTENSIVELY COMPARED WITH EXPERIMENTAL RESULTS IN CRITICAL FACILITIES AND OPERATING REACTORS. DESIGNERS HAVE CUSTOMARILY DEALT WITH DIFFERENCES BETWEEN OBSERVATION AND CALCULATION BY USE OF PESSIMISTIC ASSUMPTIONS AND BY CONTINUAL ATTEMPTS TO IMPROVE THEORETICAL APPROACHES. INDEPENDENT CHECKING IS CURRENTLY SPONSORED BY THE NUCLEAR REGULATORY COMMISSION'S OFFICE OF NUCLEAR REGULATORY RESEARCH.

16-5-3-557 IEEE NUCLEAR POWER SYSTEMS SYMPOSIUM
HAGEN, E. W.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE REVIEWS THE NUCLEAR SAFETY RELATED PORTIONS OF THE 6TH IEEE NUCLEAR POWER SYSTEMS SYMPOSIUM HELD IN WASHINGTON, D.C., DEC. 11-13, 1974. THE MEETING, HELD CONCURRENTLY WITH THE 21ST NUCLEAR SCIENCE SYMPOSIUM AND THE 14TH SCINTILLATION AND SEMICONDUCTOR COUNTER SYMPOSIUM, WAS SPONSORED BY THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE) AND THE U.S. ATOMIC ENERGY COMMISSION. IT WAS THE LATEST IN A SERIES OF MEETINGS DESIGNED SPECIFICALLY FOR ELECTRICAL ENGINEERS WHO ARE INVOLVED WITH NUCLEAR POWER GENERATION. SEVERAL SESSIONS WERE DEVOTED TO UPDATING INFORMATION ON STANDARDS, STARTUP AND OPERATING EXPERIENCES, AND INSTRUMENTATION DEVELOPMENT.

16-5-4-564 NUCLEAR SAFETY DESIGN OF THE CLINCH RIVER BREEDER REACTOR PLANT
GRAHAM, J.
WESTINGHOUSE ELECTRIC CORPORATION, PITTSBURGH, PA.
THIS ARTICLE REVIEWS THE DESIGN PHILOSOPHY AND SAFETY FEATURES OF THE 975-MW(T) CLINCH RIVER BREEDER REACTOR (CRBR), A SODIUM COOLED DEMONSTRATION REACTOR TO BE BUILT NEAR OAK RIDGE, TENN. THE OVERALL SAFETY OF THE PLANT IS BASED ON THREE LEVELS OF PROTECTION (1) RELIABLE OPERATION THROUGH INTRINSIC FEATURES OF THE DESIGN, (2) PROTECTION PROVIDED AGAINST ANTICIPATED FAULTS AND UNLIKELY EVENTS, AND (3) PROVISION FOR EXTREMELY UNLIKELY EVENTS. THE PRINCIPAL FEATURES OF EACH OF THESE THREE SAFETY DESIGN LEVELS ARE DISCUSSED. IN ADDITION, WORK IS CONTINUING ON A PARALLEL DESIGN APPROACH THAT TREATS A CORE DISRUPTIVE ACCIDENT AS A DESIGN BASIS.

16-5-4-581 SOLID RADIOACTIVE WASTE PRACTICES AT NUCLEAR POWER PLANTS
KIBBEY, A. H. + GODBEE, H. W.
HOLIFIELD NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS REVIEW OF SOLID RADIOACTIVE WASTE PRACTICES AT NUCLEAR POWER PLANTS THROUGH 1972 SHOWS THAT BOILING WATER REACTORS (BWRS) CUMULATIVELY GENERATED OVER TWICE AS MUCH WASTE AS PRESSURIZED-WATER REACTORS (PWRS) (3.3 X 10(5) VS. 1.4 X 10(5) CUBIC FT) AND PRODUCED ABOUT THE SAME CUMULATIVE THERMAL OUTPUT (2.2 X 10(8) VS. 2.5 X 10(8) MBH(T)). THE CUMULATIVE UNDECAYED CONTENTS OF THESE WASTES WERE 6.7 X 10(3) AND 7.7 X 10(3) CI FOR BWRS AND PWRS, RESPECTIVELY. GENERALLY, PWRS INCORPORATED ALL WET PROCESS WASTES EXCEPT SPENT BEAD RESINS IN CEMENT, WHEREAS SEVERAL BWRS TENDED TO DEWATER SLUDGES AND RESINS AND TO SORB EVAPORATOR CONCENTRATES ON HIGH SURFACE AREA MATERIALS WITHOUT BINDER FOR SHIPMENT AND BURIAL. A RECENT TREND FOR BWRS IS TO INCORPORATE WASTE IN SOLID MATRICES.

16-5-5-593 THE ENVIRONMENTAL IMPACT IODINE-129 RELEASED BY A NUCLEAR FUEL REPROCESSING PLANT
PALMS, J. M. + VELURI, V. R. + BOONE, F. W.
ALLIED-GENERAL NUCLEAR SERVICES, BARNWELL, S.C.
THE ENVIRONMENTAL IMPACT OF IODINE-129 RELEASED BY THE ALLIED GENERAL NUCLEAR SERVICES - BARNWELL NUCLEAR FUEL PLANT (BNFP) IS ASSESSED. ON THE BASIS OF PRESENT KNOWLEDGE, IT IS EXPECTED THAT THE PREDICTED RELEASED FROM THE PLANT WILL NOT RAISE THE CONCENTRATION OF IODINE-129 TO LEVELS THAT WOULD BE HAZARDOUS TO MAN OR THE ENVIRONMENT. THIS ARTICLE SUMMARIZES THE ANALYSES ASSOCIATED WITH THE RELEASE OF IODINE-129 TO THE ENVIRONMENT, INCLUDING THE PRESENTLY ESTIMATED BNFP RELEASES AND CALCULATIONS OF RESULTING DOSE TO MAN USING THE STATE OF THE ART DOSE MODELS. THYROID DOSES ARE CALCULATED BY THE SPECIFIC ACTIVITY MODEL AND THE CRITICAL PATHWAY MODEL. THE DEGREE OF CONSERVATIVENESS INVOLVED IN THE SPECIFIC ACTIVITY MODEL WHICH MAKES IT UNACCEPTABLE AS A REALISTIC MODEL IS DISCUSSED, AND THE CRITICAL PATHWAY MODEL IS BRIEFLY ASSESSED. THYROID DOSES FOR ADULTS AND INFANTS DUE TO INHALATION AND INGESTION ARE PRESENTED. FOR AN AIR CONCENTRATION OF 3.6 X 10(-5) PCI/M(3) OF IODINE-129, RESULTING FROM A RELEASE AT THE RATE OF 1.5 X 10(-9) CI/SEC, THE INFANT AND THE ADULT THYROID DOSES DUE TO INGESTION VIA MILK ARE CALCULATED BY THE CRITICAL PATHWAY MODEL TO BE 0.24 AND 0.12 MREM/YEAR, RESPECTIVELY. THE ADULT THYROID DOSE DUE TO INGESTION OF LEAFY VEGETABLES IS FOUND TO BE 0.04 MREM/YEAR. THE INHALATION AND WHOLE BODY DOSES ARE ORDERS OF MAGNITUDE SMALLER.

16-5-6-603 STEAM GENERATOR TUBE FAILURES - WORLD EXPERIENCE IN WATER COOLED NUCLEAR POWER REACTORS IN 1973
STEVENS-GUILLE, P. D. + HARE, M. G.
ATOMIC ENERGY OF CANADA LIMITED, CHALK RIVER, ONTARIO
THIS ARTICLE SUMMARIZES STEAM GENERATOR TUBE FAILURES IN WATER COOLED REACTORS FOR 1973. FAILURES OCCURRED IN 11 OF 49 REACTORS, MAINLY DUE TO CORROSION AND VIBRATION. THE TWO MOST IMPORTANT VARIABLES IN PREVENTING THESE FAILURES APPEAR TO BE SECONDARY WATER CHEMISTRY AND DESIGN.

16-5-6-614 OCCUPATIONAL RADIATION EXPOSURE AT NUCLEAR POWER PLANTS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE SUMMARIZES THE RESULTS OF AN INVESTIGATION OF OCCUPATIONAL RADIATION EXPOSURES AT NUCLEAR POWER PLANTS CARRIED OUT BY SAI SERVICES FOR THE ATOMIC INDUSTRIAL FORUM. OCCUPATIONAL RADIATION EXPOSURES AND THEIR SOURCES WERE INVESTIGATED AT EIGHT BOILING WATER REACTORS (BWRS) AND AT SIX PRESSURIZED WATER REACTORS (PWRS) FROM 1969 TO 1973. ACTIVATION PRODUCTS RATHER THAN FISSION PRODUCTS WERE FOUND TO BE THE MAJOR SOURCES OF RADIATION EXPOSURE TO IN-PLANT PERSONNEL FOR BOTH TYPES OF REACTORS. THE SINGLE MOST IMPORTANT NUCLIDE CONTRIBUTING TO EXPOSURES AT BWRS WAS COBALT-60. NO SINGLE NUCLIDE WAS FOUND TO BE DOMINANT IN PWR EXPOSURES, BUT STEAM GENERATOR WORK WAS THE LARGEST SOURCE OF EXPOSURE. THE ANNUAL EXPOSURE RATE WAS FOUND TO INCREASE WITH PLANT AGE ON BWRS, BUT THERE IS NO CONSISTENT PATTERN FOR EXPOSURE RATE CHANGE WITH PLANT AGE ON PWRS.

16-6-1-659 EPRI WATER REACTOR SAFETY PROGRAM
LOEWENSTEIN, W. B.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF.
THE RATIONALE, STRUCTURE, AND CURRENT STATUS OF THE ELECTRIC POWER RESEARCH INSTITUTE (EPRI) WATER REACTOR SAFETY PROGRAM ARE SUMMARIZED. THE EFFORTS EMPHASIZE QUANTIFIED ASSURANCE OF SAFETY, USUALLY BASED ON THE SYNTHESIS OF PERTINENT EXPERIMENTAL, ANALYTICAL, AND CALCULATIONAL RESULTS. THE SCOPE OF THE PROGRAM RANGES FROM THE QUANTIFIED DEFINITION OF THE COURSE OF THE POSTULATED LOSS OF COOLANT ACCIDENT TO CONTINUING ROUTINE MONITORING OF THE PRESSURE BOUNDARY. THIS INCLUDES RESEARCH ON SUCH DIVERSE EFFECTS AS TWO-PHASE FLOW BEHAVIOR IN COMPLEX GEOMETRIES, INTERACTION OF POTENTIAL TORNADO GENERATED MISSILES WITH REINFORCED CONCRETE STRUCTURES, ASPECTS OF PROBABILISTIC SAFETY APPRAISAL, AND TECHNIQUES TO QUANTIFY THE DIAGNOSIS OF THE PERFORMANCE OF THE PRESSURE BOUNDARY. THE EPRI PROGRAM EFFORTS ARE COORDINATED WITH THE NEEDS OF THE UTILITY INDUSTRY THROUGH SEVERAL ADVISORY COMMITTEES. THE PROGRAM IS COORDINATED WITH THE PROGRAMS OF NATIONAL SPONSORING AGENCIES AND MAINTAINS LIAISON WITH REACTOR VENDORS AND ARCHITECT ENGINEERS. PROGRAM SEGMENTS ARE IMPLEMENTED BY REACTOR VENDORS, ARCHITECT ENGINEERS, CONSULTING ORGANIZATIONS, NATIONAL LABORATORIES, INDEPENDENT RESEARCH ORGANIZATIONS, AND UNIVERSITIES. IN ADDITION TO COORDINATION WITH NATIONAL AGENCIES, ARRANGEMENTS FOR COOPERATION AND EXCHANGE HAVE BEEN INITIATED WITH SEVERAL FOREIGN NATIONAL AND UTILITY ORGANIZATIONS.

16-6-1-667 EPA'S ENVIRONMENTAL RADIATION ASSESSMENT PROGRAM
ROWE, W. D. + GALPIN, F. L. + PETERSON, H. T., JR.
U.S. ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.
A PRINCIPAL ROLE OF THE ENVIRONMENTAL PROTECTION AGENCY'S OFFICE OF RADIATION PROGRAMS IS TO ASSESS ENVIRONMENTAL RADIOACTIVITY LEVELS AND TO ESTIMATE THE IMPACT OF RADIATION TECHNOLOGY ON MAN AND HIS ENVIRONMENT. THIS ARTICLE DESCRIBES THE APPROACH OF THE EPA AND ITS PROGRAM TO FULFILL THIS ROLE.

16-6-2-683 FRAGMENTATION MODELING RELATIVE TO THE BREAKUP OF MOLTEN URANIUM DIOXIDE IN SODIUM
CRONENBERG, A. W. + GROLMES, M. A.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILL.
AN IMPORTANT ASPECT OF THE FUEL COOLANT INTERACTION PROBLEM RELATIVE TO LIQUID METAL COOLED FAST BREEDER REACTOR SAFETY ANALYSIS IS THE FRAGMENTATION OF MOLTEN UXIDE FUEL ON CONTACT WITH LIQUID SODIUM COOLANT. A PROPER DESCRIPTION OF THE KINETICS OF SUCH AN EVENT REQUIRES AN UNDERSTANDING OF THE BREAKUP PROCESS AND AN ESTIMATE OF THE SIZE AND DISPERSION OF SUCH FINELY DIVIDED FUEL IN THE COOLANT. IN RECENT YEARS, CONSIDERABLE INTEREST HAS CENTERED ON THE PROBLEM OF DETERMINING THE NATURE OF THE FRAGMENTATION PROCESS. THIS ARTICLE REVIEWS BOTH ANALYTIC AND EXPERIMENTAL STUDIES PERTAINING TO SUCH BREAKUP IN LIGHT OF RECENT DEVELOPMENTS IN THE UNDERSTANDING OF HEAT TRANSFER AND SOLIDIFICATION PHENOMENA DURING QUENCHING OF URANIUM DIOXIDE IN SODIUM. WHERE POSSIBLE, AN ATTEMPT IS MADE TO ASSESS THE WORK POTENTIAL FOR FRAGMENTATION OF THE VARIOUS PROPOSED MODELS AND TO COMPARE THE PREDICTED PARTICLE SIZE WITH EXPERIMENTAL RESULTS.

16-6-3-701 SAFETY INSTRUMENTATION FOR THE SODIUM COOLED FAST REACTOR
HALL, R. S.
BERKELEY NUCLEAR LABORATORIES, GLOUCESTERSHIRE, ENGLAND
THE PARTICULAR SAFETY PROBLEMS OF THE FAST REACTOR AND THE ROLE OF INSTRUMENTED PROTECTION IN RELATION TO THE OVERALL SAFETY DESIGN OF THE REACTOR ARE DISCUSSED. THE IMPORTANCE OF THE ACCIDENT SEQUENCE ARISING FROM A FAULT WITHIN ONE

SUBASSEMBLY IS INDICATED, AND THE PHYSICAL PHENOMENA INVOLVED ARE DISCUSSED WITH REGARD TO THE GENERATION OF DETECTABLE SIGNALS. SEVERAL POSSIBLE TECHNIQUES FOR DETECTING SUBASSEMBLY ACCIDENTS ARE DESCRIBED, INCLUDING THOSE WITH DETECTORS SITUATED AT THE OUTLET OF EACH SUBASSEMBLY AND ALSO THOSE INVOLVING WHOLE-CORE PARAMETERS. THE CURRENT STATUS OF THESE TECHNIQUES IS INDICATED, AND, WHERE APPROPRIATE, THE STEPS NECESSARY FOR THEIR FUTURE APPLICATION ARE OUTLINED. REFERENCE IS MADE TO THE WAY IN WHICH TYPES OF INSTRUMENTS WOULD HAVE TO BE COMBINED TO GIVE A HIGH DEGREE OF PROTECTION TO THE SYSTEM, THE ACTUAL PROTECTION REQUIRED BEING DEPENDENT ON THE OVERALL SAFETY INTENTIONS. ATTENTION IS DRAWN TO THE PROBLEMS OF MINIMIZING THE SPURIOUS TRIP RATE FOR A WELL INSTRUMENTED REACTOR, WHICH LEAD TO STRINGENT REQUIREMENTS ON INSTRUMENT RELIABILITY AND/OR REPLACEABILITY. THE POSSIBLE ROLE OF THE COMPUTER IN HANDLING THE MULTIPLICITY OF COMPLEX SIGNALS IS MENTIONED, TOGETHER WITH THE PROBLEMS THAT HAVE TO BE SOLVED BEFORE THIS CAN BE DONE. IT IS CONCLUDED THAT SATISFACTORY INSTRUMENT PROTECTION IS AVAILABLE FOR WHOLE-CORE FAULTS, BUT WITH REGARD TO SUBASSEMBLY FAULT DETECTION THE SITUATION IS LESS CLEAR. ALTHOUGH SOME INFORMATION IS AVAILABLE FOR GUIDANCE ON THE INSTRUMENTS AND THEIR SPECIFICATIONS, THE JUSTIFICATION AND ACHIEVABILITY OF THE LATTER ARE DEPENDENT ON DEVELOPMENT WORK THAT IS STILL PROCEEDING. IT MAY WELL BE THAT UNCERTAINTIES CONCERNING THE EFFECTS OF THE REACTOR ENVIRONMENT WILL REQUIRE THAT SOME OF THIS WORK TAKE THE FORM OF IN-REACTOR EXPERIMENTS.

16-6-3-714 SILICONE RUBBER INSULATED CABLES FOR CALVERT CLIFFS NUCLEAR POWER PLANT
BHATIA, P.
BALTIMORE GAS AND ELECTRIC COMPANY, BALTIMORE, MD.
EARLY IN 1970 THE BALTIMORE GAS + ELECTRIC COMPANY DECIDED TO USE SILICONE RUBBER INSULATED CABLES, SIZE NO. 2 AWG AND SMALLER, FOR ALL LOW-VOLTAGE POWER, CONTROL, AND INSTRUMENTATION APPLICATIONS FOR THE CALVERT CLIFFS NUCLEAR POWER PLANT, UNITS 1 AND 2. THE DECISION WAS BASED ON EXTENSIVE TESTS MADE BY THE COMPANY TO DETERMINE THE OPTIMUM BALANCE OF PROPERTIES OF CONTROL AND POWER CABLES TO ENSURE THEIR SATISFACTORY OPERATION DURING A SEVERE FIRE AND AFTER EXPOSURE TO RADIATION. RESULTS OF THE TESTS INDICATED THAT SILICONE RUBBER INSULATED CABLES (METHYL PHENYL VINYL BASE COMPOUND) WITH GLASS BRAID OVER THE INSULATED CONDUCTORS, ASBESTOS FILLERS, AND OVERALL ASBESTOS-BRAID JACKETS WILL OPERATE SUCCESSFULLY DURING AND AFTER AN OIL FIRE AND AFTER EXPOSURE TO A TOTAL RADIATION OF 10(8) RADS AND BORATED STEAM.

16-6-5-723 POPULATION EXPOSURES - THE EIGHTH MIDYEAR TOPICAL SYMPOSIUM OF THE HEALTH PHYSICS SOCIETY
BARTON, C. J. + DICKSON, H. W. + PARZYCK, D. C.
ROHWER, P. S. + TURNER, J. E.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE EIGHTH MIDYEAR TOPICAL SYMPOSIUM OF THE HEALTH PHYSICS SOCIETY WAS HELD AT KNOXVILLE, TENN., OCT. 21-24, 1974. ALL BUT 4 OF THE 56 PAPERS PRESENTED ARE INCLUDED IN THE PRINTED PROCEEDINGS THAT WERE DISTRIBUTED AT THE MEETING. TOPICS COVERED IN THE VARIOUS SESSIONS ARE BACKGROUND RADIATION EXPOSURES, MEDICAL RADIATION EXPOSURES (NOT REVIEWED IN THIS ARTICLE), NUCLEAR POWER EXPOSURES, DOSIMETRY, AND POPULATION EXPOSURES FROM SOURCES OTHER THAN NUCLEAR POWER. A PUBLIC FORUM ON POPULATION EXPOSURES FROM ELECTRIC POWER GENERATION NUCLEAR AND NONNUCLEAR PRODUCED SOME RATHER LIVELY INTERCHANGES BETWEEN A PANEL OF EXPERTS AND THE AUDIENCE. THE BROAD RANGE OF TOPICS COVERED IN THE SYMPOSIUM SHOWS THAT THE TASKS OF THE HEALTH PHYSICIST ARE GROWING MORE COMPLEX.

16-6-5-728 QUO VADIS, PERSONNEL MONITORING
BECKER, K.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE TENN.
WITH THE INCREASING USE OF NUCLEAR POWER AND RADIATION SOURCES, THE SELECTION OF OPTIMUM SYSTEMS FOR PERSONNEL MONITORING IS BECOMING A MATTER OF WORLDWIDE CONCERN. THE PRESENT STATUS OF PERSONNEL DOSIMETRY, SOMETIMES CHARACTERIZED BY UNSTABLE AND INACCURATE DETECTORS AND OVERSIMPLIFIED INTERPRETATION OF THE RESULTS, LEAVES MUCH TO BE DESIRED. IN PARTICULAR, PHOTOGRAPHIC FILM, ALTHOUGH HAVING CERTAIN ADVANTAGES WITH REGARD TO ECONOMICS AND INFORMATION CONTENT, UNDERGOES RAPID CHANGES IN WARM AND HUMID CLIMATES; CAREFUL SEALING REDUCES, BUT DOES NOT PREVENT, THESE PROBLEMS. THE REPLACEMENT OF FILM BY SOLID STATE DOSIMETERS, PRIMARILY THERMOLUMINESCENCE DOSIMETERS, IS IN PROGRESS OR BEING CONSIDERED BY AN INCREASING NUMBER OF INSTITUTIONS AND REQUIRES A NUMBER OF DECISIONS CONCERNING THE CHOICE OF THE OPTIMUM DETECTOR(S), BADGE DESIGN, AND EVALUATION SYSTEM. ORGANIZATIONAL MATTERS, SUCH AS THE DESIRABILITY OF AUTOMATION AND COMPUTERIZED BOOKKEEPING, ETC. THE CHANGE ALSO IMPLIES THE POTENTIAL USE OF SUCH ADVANCED CONCEPTS AS DIFFERENT DETECTORS AND MONITORING PERIODS FOR THE LARGE NUMBER OF LOW RISK PERSONS AND THE SMALL NUMBER OF HIGH RISK RADIATION WORKERS.

16-6-6-716 SUMMARY OF RADIOACTIVITY RELEASED IN EFFLUENTS FROM NUCLEAR POWER PLANTS DURING 1973
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
RELEASES OF RADIOACTIVITY IN AIRBORNE AND LIQUID EFFLUENTS AND THE NUMBER OF SHIPMENTS AND ACTIVITY OF SOLID WASTE HAVE BEEN COMPILED BY THE NUCLEAR REGULATORY COMMISSION FROM LICENSEE REPORTS FOR 1973. THE WIDE VARIATIONS IN THE RADIOACTIVITY RELEASES WERE DUE TO DIFFERENCES IN PLANT SIZE, POWER LEVEL, FUEL PERFORMANCE, AND EFFLUENT TREATMENT METHODS. DATA COVERING SPECIFIC ISOTOPES OF PARTICULAR INTEREST ARE SUMMARIZED. IN ALL CASES, RELEASES OF RADIOACTIVITY WERE ONLY SMALL FRACTIONS OF PERMISSIBLE LIMITS SET BY APPLICABLE REGULATIONS OR IN TECHNICAL SPECIFICATIONS.

17-1-1-1 PLANNING FOR NUCLEAR EMERGENCIES
MUELLER, D. W. + SELBY, J. M.
HARVARD UNIVERSITY, SCHOOL OF PUBLIC HEALTH BOSTON, MASS.
A PROPERLY DEVELOPED AND EXECUTED EMERGENCY PLAN REPRESENTS AN ADDITIONAL LEVEL OF SAFETY IN DEALING WITH POTENTIAL ACCIDENTS IN NUCLEAR FACILITIES. THIS STATE OF THE ART REVIEW OF THE SUBJECT, BASED PRIMARILY ON MATERIAL PRESENTED BY A VARIETY OF SPEAKERS DURING A SHORT COURSE HELD AT THE HARVARD SCHOOL OF PUBLIC HEALTH IN MAY 1975, SHOWS THAT, ALTHOUGH PROGRESS IS BEING MADE, ADDITIONAL WORK REMAINS TO BE DONE. A CERTAIN DEGREE OF CONFUSION HAS EXISTED BECAUSE OF THE MULTITUDE OF FEDERAL AND STATE AGENCIES HAVING RESPONSIBILITIES IN THIS FIELD. HOWEVER, STEPS ARE BEING TAKEN TO CORRECT THIS SITUATION. ALTHOUGH UPDATED PROTECTIVE ACTION GUIDES FOR AIRBORNE RELEASES HAVE BEEN PUBLISHED, SIMILAR ACTION IS NEEDED FOR LIMITATIONS ON RADIONUCLIDE INTAKE VIA FOOD AND WATER. INDICATIONS ARE THAT, FOR A SINGLE PUFF TYPE OF AIRBORNE RELEASE, IT MAY NOT BE POSSIBLE TO EVACUATE THE NEIGHBORING POPULATION WITHIN THE SHORT TIME SPAN AVAILABLE TO AVOID EXPOSURE. FOR A LONGER TERM CONTINUOUS TYPE OF AIRBORNE RELEASE, HOWEVER, EVACUATION CAN BE VERY USEFUL. STILL IN NEED OF FURTHER EVALUATION AS AN ADJUNCT OR ALTERNATIVE TO EVACUATION IS THE USE OF PROTECTIVE SHELTER AND/OR RADIO-PROTECTIVE PROPHYLAXIS. ALSO IN NEED OF ADDITIONAL STUDY AND/OR DEVELOPMENT ARE METHODS FOR ASSESSING THE NATURE AND COURSE OF AN ACCIDENT, TECHNIQUES FOR RAPIDLY ESTIMATING THE PATHWAY OF A RELEASE AND ANTICIPATED POPULATION DOSES, ASSESSMENT OF THE LONG RANGE IMPLICATIONS OF POTENTIAL WIDESPREAD RADIOACTIVE CONTAMINATION OF LAND AREAS, AND IMPROVEMENTS IN THE CAPABILITIES OF STATE AND LOCAL AGENCIES IN PROVIDING RADIOLOGICAL EMERGENCY RESPONSE.

17-1-1-15 STATE AND LOCAL GOVERNMENT RADIOLOGICAL EMERGENCY RESPONSE PLANS IN SUPPORT OF FIXED NUCLEAR FACILITIES
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE WAS ADAPTED FROM A REPORT THAT PROVIDES GUIDANCE TO STATE AND LOCAL GOVERNMENTS ON RADIOLOGICAL EMERGENCY RESPONSE PLANNING. THE REPORT LISTS SPECIFIC PLANNING OBJECTIVES FOR A RADIOLOGICAL EMERGENCY RESPONSE PLAN, ALONG WITH GUIDANCE FOR DETERMINING WHETHER A PLAN MEETS THESE OBJECTIVES. THE GUIDANCE DATA SHOULD BE INCLUDED IN STATE RADIOLOGICAL EMERGENCY RESPONSE PLANS AND, WHERE APPROPRIATE, IN OTHER STATE AND LOCAL GOVERNMENT EMERGENCY PLANS. A CHECKLIST OF MAJOR PLANNING ELEMENTS IS PROVIDED TO ASSIST BOTH EXPERIENCED AND INEXPERIENCED PLANNERS IN CONSTRUCTING A COMPREHENSIVE RADIOLOGICAL EMERGENCY RESPONSE PLAN. EACH SECTION OF THE CHECKLIST IS SUPPORTED BY SPECIFIC GUIDANCE LANGUAGE. COMPLETION OF THE CHECKLIST WILL NOT IN ITSELF CONSTITUTE A RADIOLOGICAL EMERGENCY RESPONSE PLAN BUT WILL AID IN IDENTIFYING DEFICIENCIES IN CURRENT PLANS.

17-1-2-19 PARTIAL BLOCKAGES IN LMFBR FUEL ASSEMBLIES
FONTANA, M. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EXPERIMENTAL AND ANALYTICAL DATA ON THE EFFECTS OF PARTIAL BLOCKAGES IN SIMULATED LIQUID METAL COOLED FAST BREEDER REACTOR ROD BUNDLES ARE REVIEWED AND THE RESULTS PRESENTED. EXPERIMENTS PERFORMED IN THE FUEL FAILURE MOCKUP AT OAK RIDGE NATIONAL LABORATORY WITH 13- AND 24-SUBCHANNEL INLET BLOCKAGES IN 19-ROD SODIUM COOLED ELECTRICALLY HEATED ROD BUNDLES INDICATE THAT EXCESSIVE TEMPERATURES DO NOT OCCUR AS A RESULT OF THE BLOCKAGES. SIMILAR EXPERIMENTS WITH NONHEAT GENERATING BLOCKAGES OF 6 CENTRAL SUBCHANNELS AND 14 EDGE SUBCHANNELS IN THE HEATED ZONE OF THE ROD BUNDLE INDICATE ACCEPTABLE LOCAL TEMPERATURE INCREASES AT OPERATING CONDITIONS. EXPERIMENTS WITH WATER MOCKUPS SHOW COMPLEX FLOW PATTERNS IN THE WAKE ZONE BEHIND BLOCKAGES. ESTIMATES OF LOCAL CONVECTIVE HEAT TRANSFER IN THE WAKE ZONE WERE MADE BY MEASURING MASS INTERCHANGE BETWEEN THE RECIRCULATING FLOW ZONE AND THE FREE STREAM BY SALT INJECTION TECHNIQUES. GENERALIZATIONS OBTAINED FROM THE WATER MOCKUPS WERE USED TO PREDICT TEMPERATURES IN SODIUM COOLED ROD BUNDLES. ESTIMATES INDICATE THAT LARGE BLOCKAGES (APPROXIMATELY 3 IN. IN DIAMETER) WOULD BE REQUIRED TO CAUSE SODIUM BOILING IN FULL SCALE REACTORS.

17-1-3-33 ACOUSTIC EMISSION - A CRITICAL ASSESSMENT
STAHLKOPF, K. E. + DAU, G. J.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF.
THE PURPOSE OF THIS ARTICLE IS TO HIGHLIGHT THE LIMITATIONS OF ACOUSTIC EMISSION FOR USE IN HYDROSTATIC TEST MONITORING AND CONTINUOUS MONITORING OF PRESSURE VESSELS AS DETERMINED FROM A REVIEW OF PRIOR WORK. WITH THE PRESENT STATE OF THE ART FOR MONITORING STRUCTURAL INTEGRITY, ACOUSTIC EMISSION CAN PROBABLY REVEAL ABNORMAL INCIDENTS AND THEIR LOCATIONS, BUT IT CANNOT DESCRIBE THE INCIDENT OR ITS SERIOUSNESS. SPECIFIC CONCLUSIONS ABOUT THE MATURITY OF ACOUSTIC EMISSION MONITORING ARE DRAWN, AND SUGGESTIONS ARE GIVEN FOR FUTURE RESEARCH AND DEVELOPMENT EFFORTS.

17-1-3-43 ANTICIPATED TRANSIENTS WITHOUT SCRAM - STATUS QUO
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE PURPOSE OF REPORT WASH-1270 IS TO ENSURE A HIGH DEGREE OF RELIABILITY FOR THE PLANT SAFETY SYSTEMS OF WATER COOLED NUCLEAR POWER PLANTS TO PROTECT THE HEALTH AND SAFETY OF THE PUBLIC. IMPLEMENTATION OF THE REQUIREMENTS SET FORTH IN THE COVER LETTER SENT WITH THAT REPORT TO THE POWER UTILITIES HAS BEEN PROPOSED BY THE UTILITIES, AND REVIEWS OF THESE RESPONSES AND ANALYSES ARE UNDER CONSIDERATION BY THE NUCLEAR REGULATORY COMMISSION. ACCEPTANCE OF THE UTILITIES' POSITIONS HAS NOT BEEN GRANTED. NOR HAS FURTHER GUIDANCE OR DIRECTION BEEN PROPOSED FOR POWER PLANTS NOW OPERATING OR UNDER CONSTRUCTION. FUTURE PLANTS APPARENTLY WILL HAVE TO INCORPORATE SOME AS YET UNDEFINED DESIGN FOR A DUAL ACTING PLANT SAFETY SYSTEM.

17-1-4-55 THE SAFETY OF REACTOR PRESSURE VESSELS
COOPER, W. E. + LANGER, B. F.
TELEDYNE MATERIALS RESEARCH COMPANY, WALTHAM, MASS.
WE BELIEVE THAT NUCLEAR REACTOR VESSELS ARE SAFE. DEBATE ON THIS SUBJECT HAS RANGED FROM PURELY EMOTIONAL ARGUMENTS TO LENGTHY AND COMPLICATED STATISTICAL STUDIES. THE PRESENT PAPER WAS PREPARED AS A SUMMARY STATEMENT WITHOUT TECHNICAL DETAIL, BUT WITH A BRIEF DESCRIPTION OF THE TECHNOLOGY AND OF THE MANNER IN WHICH THE TECHNOLOGY IS IMPLEMENTED IN VESSEL CONSTRUCTION.

17-1-4-62 IMPROVING REACTOR PRESSURE VESSEL AVAILABILITY BY DESIGN
COOPER, W. E.
TELEDYNE MATERIALS RESEARCH COMPANY, WALTHAM, MASS.
ALTHOUGH REACTOR PRESSURE VESSELS ARE SAFE, THEY PRESENTLY CONTRIBUTE TO THE UNAVAILABILITY TIME OF NUCLEAR POWER SYSTEMS. THIS EFFECT COULD BE REDUCED SIGNIFICANTLY BY BETTER APPLICATION OF THE NOW AVAILABLE DESIGN TECHNOLOGY. THIS ARTICLE BRIEFLY DESCRIBES THE STATUS OF THIS TECHNOLOGY, AS PERTINENT TO REACTOR PRESSURE VESSEL AVAILABILITY, AND THE APPLICATION OF THIS TECHNOLOGY DURING THE CONSTRUCTION AND OPERATION PHASES. RECOMMENDATIONS ARE THEN MADE AS TO HOW THIS TECHNOLOGY COULD BE APPLIED TO IMPROVING VESSEL AVAILABILITY.

17-1-5-68 TURBULENT DIFFUSION TYPING SCHEMES - A REVIEW
GIFFORD, F. A.
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, OAK RIDGE, TENN.
RECENT ENVIRONMENTAL CONCERNS HAVE GREATLY INCREASED THE NEED FOR TURBULENT TYPING SCHEMES IN ATMOSPHERIC DIFFUSION CALCULATIONS. THE STANDARD METHODS OF BROOKHAVEN NATIONAL LABORATORY, PASQUILL, THE TENNESSEE VALLEY AUTHORITY, AND OTHERS ARE REVIEWED, AND DIFFERENCES, INCONSISTENCIES, AND MODIFICATIONS TO THE BASIC SCHEMES ARE DISCUSSED. VARIOUS EXCEPTIONAL FLOWS OCCUR TO WHICH EXISTING TURBULENCE TYPING SCHEMES SHOULD NOT BE APPLIED DIRECTLY - DIFFUSION IN NEAR CALM, VERY STABLE CONDITIONS, DIFFUSION OVER CITIES, WATER BODIES, AND IRREGULAR TERRAIN, AND DIFFUSION IN BUILDING WAKES AND NEAR HIGHWAYS. POSSIBLE MODIFICATIONS TO TYPING SCHEMES IN THESE CASES ARE DISCUSSED. IN ALL SUCH EXCEPTIONAL CASES, MANY MORE OBSERVATIONAL DATA ARE NEEDED BEFORE RELIABLE DIFFUSION ESTIMATES CAN BE MADE.

17-1-6-87 QUALITY ASSURANCE PROBLEMS AT MIDLAND NUCLEAR POWER PLANT
MCGLOTHLAN, C. K.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE EXAMINES THE SHOW CAUSE ORDER ISSUED BY THE DIRECTOR OF REGULATION OF THE ATOMIC ENERGY COMMISSION (AEC) IN 1973 AND THE ACTIONS TAKEN BY THE AEC (NOW NUCLEAR REGULATORY COMMISSION), THE OWNER, THE ARCHITECT ENGINEER, AND OTHERS IN IDENTIFYING AND RESOLVING CERTAIN QUALITY DEFICIENCIES THAT HAVE OCCURRED SINCE 1970 IN THE DESIGN AND CONSTRUCTION PHASES OF THE MIDLAND NUCLEAR POWER PLANT. IMPROVEMENTS IN THE MIDLAND QUALITY ASSURANCE PROGRAM, WHICH RESULTED IN A RULING BY THE AEC REGULATORY STAFF IN FAVOR OF THE OWNER, ARE DISCUSSED.

17-1-6-92 SECOND SYMPOSIUM ON TRAINING OF NUCLEAR FACILITY PERSONNEL
ROTH, D. R.
GENERAL PHYSICS CORPORATION, COLUMBIA, MD.
THIS ARTICLE IS A REVIEW OF THE SECOND SYMPOSIUM ON TRAINING OF NUCLEAR FACILITY PERSONNEL, HELD MAY 11-14, 1975, AT GATLINBURG, TENN. THE SYMPOSIUM, CO-SPONSORED BY THE OAK RIDGE

NATIONAL LABORATORY AND THE AMERICAN NUCLEAR SOCIETY'S REACTOR OPERATIONS DIVISION AND OAK RIDGE SECTION, WAS ATTENDED BY UTILITY AND INDUSTRY REPRESENTATIVES AS WELL AS BY MEMBERS OF GOVERNMENT AND REGULATORY AGENCIES. IN ADDITION TO SOURCES, SELECTION, AND TRAINING OF PERSONNEL AT NUCLEAR UTILITIES, TRAINING OF OPERATORS AT FUEL PROCESSING PLANTS WAS INCLUDED. THE EDUCATIONAL COMMUNITY PRESENTED SOME NEW APPROACHES TO SUPPLYING QUALIFIED PERSONNEL FOR THE INDUSTRY, AND UTILITY PROGRAMS FOR TRAINING OF SUPPORT AND NONLICENSED PERSONNEL WERE DISCUSSED. AS EVIDENCED BY THE SYMPOSIUM, THERE IS A CONTINUING STRONG INTEREST IN EFFECTIVE TRAINING PROGRAMS. PROGRESS HAS BEEN MADE IN MANY AREAS, BUT SOURCES OF TRAINED PERSONNEL AND EVOLVING REGULATORY REQUIREMENTS CONTINUE TO BE A PROBLEM.

17-2-1-143 WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE IS A REVIEW OF THE THIRD WATER REACTOR SAFETY RESEARCH INFORMATION MEETING, SPONSORED BY THE NUCLEAR REGULATORY COMMISSION (NRC) DIVISION OF REACTOR SAFETY RESEARCH, HELD AT THE NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD., SEPT. 29-OCT. 2, 1975. THIS MEETING CONSISTED OF PARALLEL TECHNICAL PRESENTATIONS IN THE MORNING, FOLLOWED BY SEVERAL SMALLER WORKSHOPS OR DISCUSSION SESSIONS IN THE AFTERNOON. THE TECHNICAL SESSIONS WERE (1) LOSS OF COOLANT ACCIDENT TEST PROGRAM, (2) FUEL BEHAVIOR PROGRAM, (3) ANALYSIS DEVELOPMENT PROGRAM, AND (4) METALLURGY AND MATERIALS PROGRAM. OVER 575 PERSONS, INCLUDING SOME 95 FOREIGN VISITORS FROM 16 COUNTRIES, ATTENDED THE MEETING. SUMMARIES OF MOST OF THE MORNING SESSIONS, WHICH WERE AVAILABLE AT THE MEETING, HAVE BEEN FURTHER CONDENSED AND REFERENCED IN THIS ARTICLE, TOGETHER WITH SOME COMMENTARIES ON SOME OF THE AFTERNOON DISCUSSIONS. NO PROCEEDINGS WILL BE PUBLISHED. SPECIAL FEATURES OF THE MEETING, IN ADDITION TO THE REVIEW OF NRC SPONSORED WATER REACTOR SAFETY RESEARCH PROGRAMS, WERE EIGHT INVITED PAPERS BY INTERNATIONAL EXPERTS, AND INCREASED PARTICIPATION BY BOTH THE U.S. NUCLEAR INDUSTRY AND THE VARIOUS NRC SESSION CHAIRMEN WHO ARE ADMINISTRATIVELY RESPONSIBLE FOR THE WORK IN QUESTION. MANY PROBLEMS AND PROGRAMS WERE DISCUSSED, AND MUCH WAS LEARNED. IT IS REASSURING THAT THESE RESEARCH RESULTS CONTINUE TO SUBSTANTIATE OUR UNDERSTANDING OF REACTOR SAFETY.

17-2-1-171 COMPARATIVE RISK - COST - BENEFIT STUDY OF ALTERNATIVE SOURCES OF ELECTRICAL ENERGY
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS STUDY QUANTIFIES, NORMALIZES, AND COMPILES CONVENTIONAL AND SOCIETAL COSTS ASSOCIATED WITH THE PRODUCTION OF ELECTRICAL ENERGY BY CURRENTLY AVAILABLE ALTERNATIVE SYSTEM BASED ON COAL, GAS, NUCLEAR FUELS, AND HYDROENERGY. PARTICULAR EMPHASIS IS PLACED ON EXAMINING EACH ENERGY SYSTEM IN ITS ENTIRETY - BOTH THE POWER PLANT AND ITS SUPPORTING FUEL CYCLE. HOWEVER, THE STUDY IS RESTRICTED TO ROUTINE IMPACTS, INCLUDING ROUTINE ACCIDENTS WHOSE FREQUENCIES CAN BE ESTABLISHED FROM HISTORICAL DATA, FROM THE AVAILABLE DATA, WHICH ARE THOROUGHLY REFERENCED HEREIN, IT IS CONCLUDED THAT NATURAL GAS INCURS MINIMAL ENVIRONMENTAL- AND HUMAN-IMPACT COSTS BUT REMAINING SUPPLIES ARE SMALL. OIL PRESENTS CONSIDERABLY GREATER ENVIRONMENTAL AND HUMAN IMPACTS BUT SUBSTANTIALLY LESS THAN THOSE FROM COAL, WHICH IS BOTH THE MOST SERIOUS ENVIRONMENTAL OFFENDER AND THE MOST ABUNDANT DOMESTIC FUEL SOURCE. NUCLEAR FUELS, WHICH ARE ABUNDANT NATURAL RESOURCES, HAVE SOMEWHAT LESS ENVIRONMENTAL AND HUMAN IMPACTS THAN GAS. THE CONVENTIONAL FUEL COSTS OF COAL AND NUCLEAR FUEL CYCLES ARE COMPARABLE AND CONSIDERABLY LESS EXPENSIVE THAN GAS OR OIL, BUT IT APPEARS THAT THE COST OF ABATEMENT AND HEALTH AND SAFETY MEASURES WILL SIGNIFICANTLY INCREASE THE COST OF ENERGY FROM COAL OVER THAT FROM NUCLEAR FUEL.

17-2-2-185 STEAM - WATER MIXING STUDIES RELATED TO EMERGENCY CORE COOLING SYSTEM PERFORMANCE
CUDNIK, R. A. + CARBIENER, W. A.
BATTELLE COLUMBUS LABORATORIES, COLUMBUS, OHIO
THIS ARTICLE IS A REVIEW OF RECENT EXPERIMENTAL WORK RELATED TO THE INTERACTIONS BETWEEN THE PRIMARY SYSTEM FLUID AND EMERGENCY CORE COOLING (ECC) WATER IN LIGHT WATER REACTOR SYSTEMS DURING RECOVERY FROM A POSTULATED LOSS OF COOLANT ACCIDENT. THE TESTING PROGRAMS ARE EXPLORATORY SEPARATE EFFECTS TESTS IN REDUCED SIZE SIMULATORS OF REACTOR SYSTEMS. THE TESTS ADDRESS THE COLD-LEG MANOMETER LOOP, THE COLD-LEG PIPE ECCS INJECTION SECTION, AND THE DOWNCOMER ANNULUS LOWER PLENUM REGIONS OF REACTOR SYSTEMS. DATA TO DATE INDICATE THE ABSENCE OF COLD-LEG PIPE PLUGGING, THE PRESENCE OF OSCILLATORY FLOW BEHAVIOR INITIATED BY FULL PIPE FLOW, AND THE PREDOMINANT ROLE OF CONDENSATION IN BOTH THE INJECTION SECTION AND ANNULUS REGIONS.

17-2-2-194 THE RELAP4 COMPUTER CODE 1. APPLICATION TO NUCLEAR POWER PLANT ANALYSIS
SOLBRIG, C. W. + BARNUM, D. J.
AEROJET NUCLEAR COMPANY, IDAHO FALLS, IDAHO
THE RELAP4 COMPUTER CODE IS A VERY USEFUL TOOL FOR NUCLEAR SAFETY ANALYSIS. IT IS USED PRINCIPALLY IN THE ANALYSIS OF THE HYPOTHETICAL LOSS OF COOLANT ACCIDENT BUT IS ALSO USED IN SEVERAL OTHER APPLICATIONS. THIS ARTICLE IS THE FIRST OF A

THREE PART SERIES WHICH DISCUSSES, RESPECTIVELY, THE RELAP4 PROGRAM, INPUT MODELING, AND TYPICAL RESULTS, AND IS DIRECTED TOWARD THE POTENTIAL CODE USER. THIS ARTICLE DESCRIBES THE BASIC FLUID MODEL, THE IMPROVEMENTS OVER ITS PREDECESSOR, RELAP3, AND A FURTHER MODIFICATION, RELAP-EM, SPECIFICALLY DESIGNED TO PRODUCE CONSERVATIVE RESULTS. RELAP4 IS COMPARED TO OTHER SIMILAR CODES, AND THE GENERIC LIMITATIONS OF THESE CODES ARE NOTED. HOWEVER, IT IS CONCLUDED THAT RELAP4 IS AN EXAMPLE OF THE BETTER CURRENT NUCLEAR SAFETY CODES.

17-2-4-208 EQUIPMENT CELL LINERS FOR LIQUID METAL COOLED FAST BREEDER REACTORS
CHAPMAN, R. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
CONCEPTS AND PRACTICES USED IN THE DESIGN OF EQUIPMENT CELL LINERS FOR LIQUID METAL COOLED FAST BREEDER REACTOR (LMFBR) SYSTEMS WERE SURVEYED TO ASCERTAIN THE MANNER BY WHICH THE FUNCTIONAL REQUIREMENTS WERE SATISFIED. THE SEVERITY OF SODIUM SPILLS THE LINERS WERE DESIGNED TO ACCOMMODATE, AND THE PROBLEMS ENCOUNTERED IN DESIGN AND CONSTRUCTION. THE SURVEY WAS LIMITED TO 'LOOP-TYPE' LMFBRS, WITH PRIMARY INTEREST ON RECENTLY CONSTRUCTED PLANTS. THIS ARTICLE IS ESSENTIALLY THE INTRODUCTION AND SUMMARY OF A STATE OF THE ART REPORT THAT DISCUSSES STEEL LINED CONCRETE STRUCTURES, DESCRIBES CELL LINER DESIGNS USED IN SEVERAL LMFBR PLANTS, WITH PARTICULAR EMPHASIS ON THE SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR (SEFOR), WHICH USES A FIXED LINER, AND THE FAST FLUX TEST FACILITY (FFTF), WHICH USES A FREE FLOATING LINER, AND IDENTIFIES RESEARCH AND DEVELOPMENT BELIEVED NECESSARY TO PERMIT A RATIONAL AND THOROUGH ASSESSMENT OF CELL LINER DESIGN CONCEPTS.

17-2-5-216 RADIOLOGICAL ASPECTS OF ENVIRONMENTAL TRITIUM
ROHWER, P. S. + WILCOX, W. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE POTENTIAL RADIOLOGICAL IMPLICATIONS OF TRITIUM RELEASED TO THE ENVIRONMENT MUST BE ASSESSED TO DEVELOP A POLICY FOR MANAGING THE TRITIUM INVENTORY PROJECTED FOR THE NUCLEAR POWER INDUSTRY, WHICH ALREADY PRODUCES TRITIUM IN MEGACURIE QUANTITIES ANNUALLY. DEVELOPMENT OF FUSION REACTORS WILL CREATE LARGE POTENTIAL SOURCES FOR CONTINUOUS AND PULSE RELEASES OF TRITIUM, MUCH OF IT AS TRITIUM GAS. AT PRESENT 90 PERCENT OF THE TRITIUM PRODUCED IS RELEASED IN GASEOUS AND LIQUID EFFLUENTS TO BE DEPOSITED IN THE HYDROSPHERE AS TRITIATED WATER. TWO ALTERNATIVES MUST BE CONSIDERED RELATIVE TO A LONG TERM POLICY FOR TRITIUM MANAGEMENT. ONE METHOD IS TO DILUTE AND DISPERSE THE TRITIUM FROM POWER STATIONS AND NUCLEAR FUEL REPROCESSING PLANTS AT A RATE COMMENSURATE WITH PRODUCTION AT THE FACILITY, AND THE SECOND METHOD IS TO TAKE STEPS TO CONTAIN THE TRITIUM FOR STORAGE. IN THIS ARTICLE A NUMBER OF FACTORS THAT INFLUENCE THE MAGNITUDE OF THE ESTIMATED RADIOLOGICAL IMPACT OF TRITIUM ON MAN ARE DISCUSSED, AND KEY POINTS CONCERNING THE BEHAVIOR OF TRITIUM ALONG THE EXPOSURE PATHWAYS TO MAN ARE SUMMARIZED. BIOACCUMULATION FACTORS FOR TRITIUM APPROXIMATE UNITY FOR ALL HYDROGEN POOLS IN SPITE OF THE LARGE MASS DIFFERENCE OF TRITIUM RELATIVE TO PROTIUM. THE QUALITY FACTOR FOR TRITIUM RELATING LINEAR ENERGY TRANSFER AND BIOLOGICAL EFFECTIVENESS IS CURRENTLY 1.0. HOWEVER, THE POSSIBLE NEED FOR A LARGER QUALITY FACTOR, PARTICULARLY FOR LOW DOSES AND DOSE RATES, IS ACKNOWLEDGED. OTHER TOPICS DISCUSSED INCLUDE TRANSMUTATION AND POSITION EFFECTS. UNCERTAINTIES CONCERNING THE OXIDATION RATE OF TRITIUM GAS IN THE ENVIRONMENT, THE POSSIBLE IMPORTANCE OF THE AGE OF THE EXPOSED INDIVIDUAL, AND CURRENT RADIATION SAFETY GUIDES THAT LIMIT THE EXPOSURE OF MAN TO TRITIUM. THE ESTIMATED DOSE TO MAN FROM ORGANICALLY BOUND TRITIUM IS THOUGHT TO INCREASE THE DOSE ESTIMATES CALCULATED ON THE BASIS OF TISSUE WATER TRITIUM ALONE BY APPROXIMATELY 20 PERCENT. THUS THE ESTIMATED TOTAL DOSE TO MAN FOR INTAKES OF ENVIRONMENTAL TRITIUM IS 0.07 MREM/MICRO-CURIES.

17-2-5-223 A SURVEY OF FIELD MEASUREMENTS OF ATMOSPHERIC DIFFUSION UNDER LOW WIND SPEED INVERSION CONDITIONS
VAN DER HOVEN, I.
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SILVER SPRING, MD.
MEASURED PLUME PEAK CONCENTRATIONS FROM FIVE SEPARATE FIELD EXPERIMENTS UNDER LOW WIND SPEED INVERSION CONDITIONS ARE ANALYZED AND COMPARED WITH COMPUTATIONS BASED ON DIFFUSION PARAMETER-TYPING PROCEDURES CURRENTLY IN USE BY THE U.S. NUCLEAR REGULATORY COMMISSION. IN ALL CASES THE MEASURED CONCENTRATIONS FROM GROUND SOURCES WERE LOWER THAN CALCULATED VALUES. THE DIFFERENCE BEING PRIMARILY DUE TO ENHANCED CROSSWIND SPREAD. MOREOVER, THE DIFFERENCES APPEARED TO BE A FUNCTION OF SURFACE ROUGHNESS, BEING GREATEST OVER HILLY FORESTED TERRAIN.

17-2-6-231 STEAM GENERATOR TUBE FAILURES - WORLD EXPERIENCE IN WATER COOLED NUCLEAR POWER REACTORS IN 1974
HARE, M. G.
CHALK RIVER NUCLEAR LABORATORIES, ONTARIO, CANADA
STEAM GENERATOR TUBE FAILURES WERE REPORTED AT 25 OF 59 WATER COOLED NUCLEAR POWER REACTORS SURVEYED IN 1974, COMPARED TO 11 OF 49 IN 1973. THIS ARTICLE SUMMARIZES THESE FAILURES, MOST OF WHICH, WHERE THE CAUSE IS KNOWN, WERE THE RESULT OF CORROSION. WATER CHEMISTRY CONTROL, INSPECTION AND REPAIR PROCEDURES, AND FAILURE RATES ARE DISCUSSED.

17-3-1-281 ATMOSPHERIC RELEASE ADVISORY CAPABILITY
DICKERSON, M. H. + ORPHAN, R. C.
LAWRENCE LIVERMORE LABORATORY, LIVERMORE, CALIF.
THE ATMOSPHERIC RELEASE ADVISORY CAPABILITY (ARAC) IS A CONCEPT FOR A SERVICE TO FACILITIES REQUIRING A MEANS OF REAL TIME PREDICTION OF THE EXTENT OF HEALTH HAZARDS THAT MAY RESULT FROM A RELEASE OF RADIONUCLIDES AND OTHER TOXIC MATERIALS. THE ARAC SYSTEM, SPONSORED BY THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION (ERDA), CONSISTS OF A NETWORK OF SERVICED SITE FACILITIES AND A CENTRAL FACILITY LOCATED AT THE UNIVERSITY OF CALIFORNIA, LAWRENCE LIVERMORE LABORATORY (LLL). SINCE 1973, WHEN THE CONCEPT WAS INITIATED, A JOINT FEASIBILITY STUDY OF THE ARAC SYSTEM HAS BEEN CONDUCTED BY LLL AND SAVANNAH RIVER LABORATORY (SRL). A SYSTEM OF THREE SITES, LLL, SRL, AND THE ROCKY FLATS PLANT, IS BEING TESTED AND EVALUATED DURING FY 1976. PLANS ARE READY TO IMPLEMENT THE ARAC SERVICE FOR ADDITIONAL ERDA NUCLEAR FACILITIES OVER THE NEXT 3 YEARS. THIS ARTICLE BRIEFLY DESCRIBES THE ARAC CONCEPT, DISCUSSES THE PROGRESS TO DATE, AND OUTLINES FUTURE PLANS FOR DEVELOPING THE SYSTEM.

17-3-1-289 AMERICAN NUCLEAR SOCIETY TOPICAL MEETING - NUCLEAR SAFETY 1975
KEILHOLTZ, G. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE BRIEFLY REVIEWS THE AMERICAN NUCLEAR SOCIETY TOPICAL MEETING ON NUCLEAR SAFETY HELD AT TUCSON, ARIZ., OCT. 5-8, 1975. A COMPREHENSIVE SURVEY WAS MADE OF SAFETY ASPECTS OF THE CONTEMPORARY UTILIZATION OF NUCLEAR ENERGY, WITH EMPHASIS ON FUEL PROCESSING AND TRANSPORT, REACTOR PLANT SAFETY, AND NUCLEAR WASTE MANAGEMENT. INVITED SPEAKERS FROM INDUSTRY, UTILITIES, AND GOVERNMENT DISCUSSED SUBJECTS BASED ON THE EXPERIENCE OF THE LIGHT WATER AND GAS COOLED REACTOR INDUSTRIES. THE INTERNATIONAL PROGRAMS IN KEY AREAS WERE COVERED.

17-3-2-293 THE RELAP4 COMPUTER CODE 2. ENGINEERING DESIGN OF THE INPUT MODEL
BARNUM, D. J. + SOLBRIG, C. W.
AEROJET NUCLEAR COMPANY, IDAHO FALLS, IDAHO
THE RELAP4 COMPUTER CODE IS AN IMPORTANT ANALYSIS TOOL FOR NUCLEAR SAFETY ANALYSIS. IT IS USED PRINCIPALLY IN THE ANALYSIS OF THE HYPOTHETICAL LOSS OF COOLANT ACCIDENT BUT IS ALSO USED IN SEVERAL OTHER APPLICATIONS. THIS ARTICLE IS THE SECOND OF A THREE PART SERIES WHICH DISCUSSES, RESPECTIVELY, THE RELAP4 PROGRAM, INPUT MODELING, AND TYPICAL RESULTS. IN THIS ARTICLE IS DESCRIBED SOME OF THE CONSIDERATIONS REQUIRED TO MODEL A THERMAL AND HYDRAULIC SYSTEM WITH PARTICULAR EMPHASIS IN LIGHT WATER NUCLEAR POWER REACTORS. ENGINEERING DECISIONS REQUIRED IN PREPARING INPUT ARE AS IMPORTANT IN THE FINAL CODE RESULTS AS THE CODE ITSELF. CODES THAT ARE SIMILAR TO RELAP4 (MENTIONED IN PART 1) REQUIRE SIMILAR INPUT CONSIDERATIONS. THE ARTICLE'S CONCLUSION IS THAT THE INPUT DESCRIPTION OF A SYSTEM IS NOT UNIQUE, AND DIFFERENT MODELERS WOULD PRODUCE DIFFERENT INPUT WITH CONSEQUENT DIFFERENT OUTPUT. HOWEVER, IT IS ALWAYS POSSIBLE TO OBTAIN CONSERVATIVE RESULTS, IF DESIRED, WITH THE USE OF THE EVALUATION MODEL (EM) VERSION OF THE CODE.

17-3-2-312 AIRCRAFT CRASH PROBABILITIES
(EDITOR'S NOTE - A COMPREHENSIVE REVIEW OF THE RISK OF AIRCRAFT CRASH TO NUCLEAR POWER PLANTS WAS PRESENTED IN NUCLEAR SAFETY 15(3). THE PRESENT ARTICLE IS TAKEN FROM THE NRC REACTOR SAFETY STUDY AND SUMMARIZES THE PROCEDURE FOLLOWED BY THE REGULATORY STAFF IN ASSESSING AIRCRAFT RISK AND ALSO TABULATES CRASH PROBABILITIES. SUCH INFORMATION IS NECESSARY FOR AN AIRCRAFT HAZARDS ANALYSIS AS DESCRIBED IN THE NRC REGULATORY GUIDE.)

17-3-3-315 HUMAN RELIABILITY ANALYSIS
THIS EDITED VERSION OF HUMAN RELIABILITY ANALYSIS WAS TAKEN FROM THE RISK ASSESSMENT ANALYSIS AS ORIGINALLY PRESENTED IN REPORT WASH-1400, THE REACTOR SAFETY STUDY. THE REFERENCES GIVEN IN THE REPORT ARE SUPPLEMENTED BY THOSE IN THE POSTSCRIPT, AND A SHORT BIBLIOGRAPHY IS APPENDED.

17-3-4-327 NEUTRON IRRADIATION EMBRITTLEMENT OF REACTOR PRESSURE VESSEL STEELS
STEELE, L. E.
NAVAL RESEARCH LABORATORY, WASHINGTON, D. C.
THE FUTURE OF NUCLEAR POWER DEPENDS IMPORTANTLY ON THE ASSURANCE OF SAFETY AND RELIABILITY. THE PRIMARY PRESSURE BOUNDARY, ESPECIALLY THE CORE REGION PRESSURE VESSEL, MUST WITHSTAND THE USUAL SERVICE CONDITIONS PLUS NEUTRON RADIATION, WHICH EMBRITTLES, HARDENS, AND STRENGTHENS THE STEEL USED IN THE PRESSURE VESSEL. THIS ARTICLE REVIEWS THE CRITICAL FACTORS ASSOCIATED WITH RADIATION EMBRITTLEMENT AND THE MEASURES THAT CAN BE TAKEN TO MINIMIZE THIS EFFECT AND THUS ENHANCE SYSTEM SAFETY FOR LIGHT WATER REACTORS.

17-3-5-344 IDENTIFICATION OF POTENTIAL IMPROVEMENTS IN ENVIRONMENTAL SURVEILLANCE TECHNIQUES
WAITE, D. A. + DENHAM, D. H.
PACIFIC NORTHWEST LABORATORIES, RICHLAND, WASH.
IN THE LAST 2 YEARS, SEVERAL POLLS WERE TAKEN AMONG DIFFERENT COMPONENTS OF THE APPLIED ENVIRONMENTAL SURVEILLANCE COMMUNITY TO IDENTIFY AREAS OF ENVIRONMENTAL SURVEILLANCE METHODOLOGY WHICH DESERVE PRESENT AND FUTURE INVESTIGATIONAL EMPHASIS.

'PROGRAM DESIGN RATIONALE,' 'DATA HANDLING AND INTERPRETATION,' AND 'QUALITY CONTROL' CONSISTENTLY RANKED 1, 2, AND 3. 'SAMPLING' AND 'SAMPLE ANALYSIS' RANKED 4 AND 5. IMPROVEMENTS IN PROGRAM RATIONALE AND DATA INTERPRETATION METHODOLOGY ARE CURRENTLY BEING EFFECTED THROUGH THE USE OF CRITICAL PATHWAY ANALYSIS AND DISTRIBUTION ANALYSIS. THE USE OF EXISTING REGIONAL ENVIRONMENTAL SURVEILLANCE DATA AND PAST KNOWLEDGE OF CONTAMINANT TRANSPORT CHARACTERISTICS MAKES THE PROCESS OF ELIMINATING NONCRITICAL CONTAMINANTS AND MEDIA RELATIVELY SIMPLE, SO THAT FURTHER INVESTIGATION OF CRITICAL PATHWAYS AND CONTAMINANTS CAN BE EMPHASIZED. DISTRIBUTION ANALYSIS CAN BE USED WITH CONFIDENCE FOR INTERPRETING THE DATA IN TERMS OF SAMPLE REPRESENTATIVENESS AND FOR THE IDENTIFICATION OF TYPICAL ENVIRONMENTAL LEVELS (FROM GEOMETRIC MEANS) AND EXPECTED UPPER LIMITS (STANDARD GEOMETRIC DEVIATIONS).

17-3-5-351 RADIATION DOSES AND EFFECTS ESTIMATED FOR AQUATIC BIOTA EXPOSED TO RADIOACTIVE RELEASES FROM LOW FUEL CYCLE FACILITIES

BLAYLOCK, B. G. + WITHERSPOON, J. P.

OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.

AQUATIC ORGANISMS ARE EXPOSED TO RADIONUCLIDES RELEASED TO THE ENVIRONMENT DURING VARIOUS STEPS OF THE NUCLEAR FUEL CYCLE. ROUTINE RELEASES FROM THESE PROCESSES ARE RESTRICTED IN COMPLIANCE WITH THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION, WHICH RECOMMENDS LIMITS FOR RADIATION DOSES TO THE GENERAL PUBLIC. IT IS GENERALLY ACCEPTED THAT AQUATIC ORGANISMS WILL NOT RECEIVE DAMAGING EXTERNAL RADIATION DOSES IN SUCH ENVIRONMENTS, BECAUSE OF THE POSSIBLE BIOACCUMULATION OF RADIONUCLIDES, HOWEVER, THERE IS CONCERN THAT AQUATIC ORGANISMS MIGHT BE ADVERSELY AFFECTED BY INTERNAL DOSES. THE OBJECTIVES OF THIS ARTICLE ARE (1) TO ESTIMATE THE RADIATION DOSE RECEIVED BY AQUATIC BIOTA FROM THE DIFFERENT PROCESSES AND TO DETERMINE THE MAJOR DOSE CONTRIBUTING RADIONUCLIDES AND (2) TO ASSESS THE IMPACT OF ESTIMATED DOSES ON AQUATIC BIOTA. DOSE ESTIMATES ARE MADE BY USING MEASUREMENTS OF RADIONUCLIDE CONCENTRATIONS IN THE LIQUID EFFLUENTS OF REPRESENTATIVE FACILITIES. WHERE SUCH MEASUREMENTS ARE NOT AVAILABLE, PREDICTED RADIOACTIVE RELEASES TO THE AQUATIC ENVIRONMENT ARE USED. ALTHOUGH RADIOACTIVE RELEASES FROM REACTORS USED TO GENERATE ELECTRICAL ENERGY HAVE RECEIVED THE MOST ATTENTION AND ARE THE BEST DOCUMENTED, THIS EVALUATION SHOWS THE POTENTIAL FOR A GREATER RADIATION DOSE TO AQUATIC BIOTA FROM THE NUCLEAR FUEL-SUPPLY FACILITIES (I.E., MINING AND MILLING). THE EFFECTS OF CHRONIC LOW LEVEL RADIATION ON AQUATIC ORGANISMS ARE DISCUSSED FROM SOMATIC AND GENETIC VIEWPOINTS. ON THE BASIS OF THE BODY OF RADIOBIOLOGICAL EVIDENCE ACCUMULATED TO DATE, NO SIGNIFICANT DELETERIOUS EFFECTS ARE PREDICTED FOR POPULATIONS OF AQUATIC ORGANISMS EXPOSED TO THE ESTIMATED DOSE RATES RESULTING FROM ROUTINE RELEASES FROM CONVERSION, ENRICHMENT, FABRICATION, REACTOR AND REPROCESSING FACILITIES. AT THE DOSES ESTIMATED FOR MILLING AND MINING OPERATIONS, IT WOULD BE DIFFICULT TO DETECT RADIATION EFFECTS ON AQUATIC POPULATIONS. HOWEVER, THE SIGNIFICANCE OF SUCH RADIATION EXPOSURES TO AQUATIC POPULATIONS CANNOT BE FULLY EVALUATED WITHOUT FURTHER RESEARCH ON EFFECTS OF CHRONIC LOW LEVEL RADIATION.

17-3-6-363 THE SAFETY OF WORKERS IN THE NUCLEAR FUEL AND REACTOR INDUSTRIES

BAKER, K. R.

U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, WASHINGTON, D.C.

THIS ARTICLE REVIEWS SAFETY RELATED DATA FOR 1973 AND 1974 COLLECTED FROM PRIVATE INDUSTRIES ENGAGED IN THE PRODUCTION OF URANIUM FUEL OR REACTOR COMPONENTS FOR COMMERCIAL NUCLEAR POWER REACTORS. OCCUPATIONAL INJURY AND ILLNESS INCIDENCE RATES CALCULATED FROM THE DATA ARE COMPARED WITH THOSE OF OTHER INDUSTRIES. RADIOLOGICAL HEALTH DATA ARE ALSO PRESENTED AND DISCUSSED.

17-4-1-411 NUCLEAR ENERGY CENTER SITE SURVEY - 1975

NRC OFFICE OF SPECIAL STUDIES, WASHINGTON, DC

(EDITOR'S NOTE - THE ENERGY REORGANIZATION ACT OF 1974 REQUIRED THE NEWLY ESTABLISHED U.S. NUCLEAR REGULATORY COMMISSION (NRC) TO UNDERTAKE A NUCLEAR ENERGY CENTER SITE SURVEY. THAT SURVEY AND THE CONCOMITANT CONSIDERATIONS ARE CONTAINED IN USNRC REPORT NUREG-0001 PUBLISHED JANUARY 1976 AND SOLD BY NTIS. THE FINAL REPORT INCLUDES SEVERAL SEPARATE DOCUMENTS AS FOLLOWS - EXECUTIVE SUMMARY (20 PAGES), $4.00. PART I, SUMMARY AND CONCLUSIONS (220 PAGES), $8.00. PART I, APPENDIX A, U.S. MAP COARSE SCREENING RESULTS, $3.50. PART II, THE U.S. ELECTRIC POWER SYSTEM AND THE POTENTIAL ROLE OF NUCLEAR ENERGY CENTERS (225 PAGES), $8.00. PART III, TECHNICAL CONSIDERATIONS (615 PAGES), $16.75. PART IV, PRACTICAL ISSUES OF IMPLEMENTATION (700 PAGES), $18.75. PART V, RESOURCE AVAILABILITY AND SITE SCREENING (230 PAGES), $8.00. INCLUDED IN THIS ARTICLE (WITH MINOR EDITING) ARE SEC. 1, INTRODUCTION AND RESULTS, FROM THE EXECUTIVE SUMMARY, A U.S. MAP CONTAINING THE COARSE SCREENING RESULTS, AND A BIBLIOGRAPHY OF THE LITERATURE ON NUCLEAR ENERGY CENTERS PREPARED BY THE NUCLEAR SAFETY INFORMATION CENTER. THE NRC REPORT INDICATES THAT NUCLEAR ENERGY CENTERS, WITH UP TO 20 NUCLEAR POWER REACTORS, CAN BE FEASIBLE AND PRACTICAL IN MANY LOCATIONS BUT THAT FEDERAL AND STATE PARTICIPATION WOULD PROBABLY BE REQUIRED TO FURTHER THE DEVELOPMENT OF A SUBSTANTIAL NUMBER OF CENTERS.)

17-4-2-422 THE RELAP4 COMPUTER CODE III. LOCA ANALYSIS RESULTS OF A TYPICAL PWR PLANT
BARNUM, D. J. + SOLBRIG, C. W.
AEROJET NUCLEAR COMPANY, IDAHO FALLS, IDAHO
THE RELAP4 COMPUTER PROGRAM IS A VALUABLE TOOL FOR USE IN NUCLEAR SAFETY ANALYSIS. IT IS USED PRINCIPALLY IN THE ANALYSIS OF THE HYPOTHETICAL LOSS OF COOLANT ACCIDENT BUT IS ALSO USED IN SEVERAL OTHER APPLICATIONS. THIS ARTICLE IS THE LAST OF A THREE PART SERIES THAT DISCUSSES (1) THE RELAP4 PROGRAM, (2) INPUT MODELING, AND (3) TYPICAL RESULTS. THIS ARTICLE CONSIDERS THE INPUT REQUIRED TO MODEL A TYPICAL FOUR-LOOP PRESSURIZED WATER REACTOR, THE CALCULATIONAL RESULTS FOR THIS PLANT, AND THE PHYSICAL PHENOMENA THAT THESE RESULTS REPRESENT. THE CALCULATIONS WERE PERFORMED WITH THE STANDARD VERSION OF RELAP4 (THE LATEST PUBLICLY AVAILABLE VERSION) INSTEAD OF THE CONSERVATIVE VERSION USED FOR LICENSING. THE RESULTS ARE REPRESENTATIVE OF LARGE WATER REACTORS, BUT DIFFERENT DESIGNS WILL EXHIBIT DIFFERENT PHENOMENA.

17-4-3-437 RELIABILITY ANALYSIS OF THE SCRAM SYSTEM OF THE MISSOURI UNIVERSITY RESEARCH REACTOR
WERNER, R. A. + LOYALKA, S. K.
UNIVERSITY OF MISSOURI, COLUMBIA, MISSOURI
THE RELIABILITY ANALYSIS OF ANTICIPATED TRANSIENTS WITHOUT SCRAM IS A TOPIC OF CONSIDERABLE SIGNIFICANCE IN REACTOR SAFETY STUDIES. THIS ARTICLE DESCRIBES THE RESULTS OF A RECENTLY COMPLETED STUDY ON THE RELIABILITY OF THE MISSOURI UNIVERSITY RESEARCH REACTOR (MURR) SCRAM SYSTEM. FOR THIS REACTOR IT HAS BEEN DETERMINED THAT THE FAILURE TO INITIATE A SCRAM AUTOMATICALLY OR MANUALLY WITHIN 7.5 SEC OF AN ISOLATION VALVE CLOSURE CAN LEAD TO CORE MELTDOWN. SINCE VALVE CLOSURE IS A CREDIBLE ACCIDENT (IT HAS OCCURRED ONCE DURING THE PAST 5 YEARS), IT IS IMPORTANT TO KNOW THE RELIABILITY OF THE SCRAM SYSTEM. THE AUTHORS HAVE USED THE EVENT AND FAULT TREE METHODOLOGIES TO ANALYZE ACCIDENT SEQUENCES AND THE SCRAM SYSTEM. SEVERAL COMMON MODE FAILURES HAVE BEEN IDENTIFIED, AND THE AVAILABILITY PROBABILITIES FOR EACH PRIMARY EVENT WERE OBTAINED BY A DETAILED EXAMINATION OF THE MURR OPERATING RECORDS. DETAILED ANALYSIS SHOWS THAT THE MURR SCRAM SYSTEM IS HIGHLY RELIABLE AND COMPARES FAVORABLY WITH THE CORRESPONDING RESULTS FOR SURRY I, WHICH WAS DISCUSSED IN THE REACTOR SAFETY STUDY.

17-4-4-447 RELATION OF INTERMEDIATE SIZED PRESSURE VESSEL TESTS TO LWR SAFETY
MERKLE, J. G. + WHITMAN, G. D. + BRYAN, R. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
UNDER THE AUSPICES OF THE HEAVY-SECTION STEEL TECHNOLOGY PROGRAM AT OAK RIDGE NATIONAL LABORATORY, EIGHT INTERMEDIATE SIZED (6-IN. WALL THICKNESS AND 39-IN. OUTSIDE DIAMETER) STEEL PRESSURE VESSELS CONTAINING CAREFULLY PREPARED AND SHARPENED SURFACE CRACKS HAVE BEEN TESTED TO PROVIDE AN IMPROVED QUANTITATIVE BASIS FOR EVALUATING THE SAFETY MARGINS AGAINST FRACTURE OF NUCLEAR REACTOR PRESSURE VESSELS. THE CYLINDRICAL REGIONS OF THE TEST VESSELS WERE FABRICATED FROM EITHER A508 CLASS 2 FORGING STEEL OR A533, GRADE B, CLASS 1 STEEL PLATE. THE FLAWS IN THE TEST VESSELS WERE 1.20 TO 5.30 IN. DEEP, AND TEST TEMPERATURES RANGED FROM 32F TO 196F. EXTENSIVE FAST FRACTURE WAS OBSERVED, AS EXPECTED, AT 32F AT A PRESSURE NEAR THE GROSS YIELD PRESSURE OF THE TEST VESSEL, AND TWO VESSELS LEAKED WITHOUT FRACTURING AT OR SLIGHTLY ABOVE 190F. EXTENSIVE FRACTURE ANALYSES WERE PERFORMED ON ALL VESSELS. THE ANALYTICAL STUDIES PERFORMED INDICATE THAT, BELOW THE UPPER-SHELF TEMPERATURE RANGE, LINEAR ELASTIC FRACTURE MECHANICS (EXPRESSED IN TERMS OF STRAIN) IS ACCURATE OR CONSERVATIVE, DEPENDING ON TRANSVERSE RESTRAINT CONDITIONS PRIOR TO THE ONSET OF THROUGH THE THICKNESS YIELDING. IN ADDITION, IN THE CYLINDRICAL REGION OF A VESSEL, WITHIN THE UPPER SHELF TEMPERATURE RANGE, FAILURE IS CONTROLLED BY THE ONSET OF PLASTIC INSTABILITY IN THE REGION SURROUNDING THE FLAW IF THE UPPER SHELF TOUGHNESS IS SUFFICIENTLY HIGH, FOR SURFACE FLAWS OF LESS THAN HALF THE TEST VESSEL WALL THICKNESS IN DEPTH, FAILURE LOADS ARE APPROXIMATELY THREE TIMES THE CODE DESIGN PRESSURE OF THE TEST VESSELS. APPLICATION OF THE ANALYSIS PROCEDURES DEVELOPED FOR THESE TESTS ON INTERMEDIATE SIZED VESSELS TO A HYPOTHETICAL REACTOR PRESSURE VESSEL INDICATES THAT A SIMILAR MARGIN OF SAFETY IS INHERENT IN FULL SCALE VESSELS.

17-4-5-464 CURRENT STATUS OF THE PLUTONIUM HOT PARTICLE PROBLEM
RICHMOND, C. R.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
IN FEBRUARY 1974 THE NATURAL RESOURCES DEFENSE COUNCIL, INC. (NRDC), BROUGHT A PETITION TO THE ATTENTION OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY AND THE U.S. ATOMIC ENERGY COMMISSION WHICH CALLED FOR A REDUCTION IN RADIATION STANDARDS FOR INSOLUBLE, INHALED ALPHA EMITTING TRANSURANIUM ELEMENTS BY A FACTOR OF 115,000. THE PETITION TO AMEND RADIATION PROTECTION STANDARDS AS THEY APPLY TO HOT PARTICLES WAS SUBMITTED ALONG WITH A SUPPORTING DOCUMENT ENTITLED 'RADIATION STANDARDS FOR HOT PARTICLES.' THIS ARTICLE SUMMARIZES THE RESPONSES OF VARIOUS AGENCIES, ORGANIZATIONS, AND INDIVIDUALS THAT HAVE APPEARED DURING THE TWO YEARS SINCE THE PETITION WAS SUBMITTED. THE BULK OF SCIENTIFIC EVIDENCE AVAILABLE TO DATE DOES NOT APPEAR TO SUPPORT THE PETITION OR THE SUPPORTING HYPOTHESIS.

NOT CONSIDERED AT THIS TIME ARE CHANGES IN THE ORIGINAL PETITION OR REBUTTALS PREPARED IN RESPONSE TO SOME OF THE WORKS PRESENTED IN THIS ARTICLE.

17-4-5-471 NATURAL BACKGROUND RADIATION IN THE UNITED STATES
NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS.
WASHINGTON, D.C.
(EDITOR'S NOTE - RADIATION IN THE ENVIRONMENT FROM NATURAL SOURCES IS THE MAJOR SOURCE OF RADIATION EXPOSURE TO MAN. FOR THIS REASON IT IS FREQUENTLY USED AS A STANDARD OF COMPARISON FOR EXPOSURES FROM MEDICAL USES, WEAPONS TESTS FALLOUT, AND NUCLEAR POWER. TO MAKE NATURAL BACKGROUND RADIATION DATA MORE ADAPTABLE, THE NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS (NCRP) DEFINED THE SOURCES OF EXPOSURE IN EXPLICIT DETAIL IN A COMPREHENSIVE REPORT, COMPLETE WITH ABOUT 300 PERTINENT REFERENCES. THIS NUCLEAR SAFETY ARTICLE CONTAINS THE SUMMARY FROM THAT REPORT AND SOME EXCERPTS FROM APPENDIX B OF THE REPORT. THE REPORT IS ENTITLED 'NATURAL BACKGROUND RADIATION IN THE UNITED STATES' AND IS AVAILABLE AS NCRP REPORT 45 FROM NCRP PUBLICATIONS, P.O. BOX 30175, WASHINGTON D.C. 20014. AN ATTRACTIVE FEATURE IN THE PRESENTATION OF THE DATA IS THAT THEY ARE EXPRESSED IN TERMS OF THE CRITICAL ORGANS WHICH ARE EXPOSED. ALTHOUGH THE MAJOR CONTRIBUTION TO RADIATION DOSE TO HUMANS IS FROM NATURAL BACKGROUND, THE GREATEST PORTION OF MAN MADE RADIATION DOSE IS DUE TO EXPOSURES ACCRUED DURING MEDICAL DIAGNOSTIC PROCEDURES. THE ESTIMATED ANNUAL GENETICALLY SIGNIFICANT DOSE CONTRIBUTIONS FROM RADIOGRAPHIC EXAMINATIONS IN THE UNITED STATES IN 1970 IS APPROXIMATELY 20 MRADS (APPROXIMATELY EQUALS 20 MREMS) (SOURCE - GONAD DOSES AND GENETICALLY SIGNIFICANT DOSE FROM DIAGNOSTIC RADIOLOGY U.S., 1969 AND 1970, BUREAU OF RADIOLOGICAL HEALTH, EDUCATION AND WELFARE, APRIL 1976). ALSO, THE CONTRIBUTION FROM DEVELOPING NUCLEAR POWER INDUSTRY IS EXPECTED TO CONTRIBUTE A POPULATION DOSE OF LESS THAN 1 PERCENT OF NATURAL BACKGROUND.

17-4-6-475 PIPE CRACKING IN BOILING WATER REACTORS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
(EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED FROM A NUCLEAR REGULATORY COMMISSION REPORT ENTITLED' INVESTIGATION AND EVALUATION OF CRACKING IN AUSTENITIC STAINLESS STEEL PIPING OF BOILING WATER REACTOR PLANTS.' THIS REPORT WAS PREPARED BY THE PIPE CRACKING STUDY GROUP THAT WAS FORMED BY NRC TO INVESTIGATE THIS PROBLEM AFTER A SERIES OF SUCH CRACKS HAD OCCURRED. THE STUDY GROUP CONCLUDED THAT THE CRACKS WERE CAUSED BY INTERGRANULAR STRESS CORROSION AND MADE EXTENSIVE RECOMMENDATIONS FOR (1) THE EARLY IDENTIFICATION OF SUCH CRACKS IN OPERATING PLANTS AND (2) THE ULTIMATE REDUCTION OF THIS PHENOMENON. THE STUDY GROUP ALSO CONCLUDED THAT THE PROBABILITY WAS EXTREMELY LOW THAT THE PRESENCE OF SUCH CRACKS COULD LEAD TO A SIGNIFICANT SAFETY HAZARD TO THE PUBLIC. INCLUDED AT THE END OF THIS ARTICLE IS A BIBLIOGRAPHY PREPARED BY THE STUDY GROUP.)

17-5-1-525 COST - BENEFIT AND RISK - BENEFIT ASSESSMENT FOR NUCLEAR POWER PLANTS
EICHHOLZ, G. G.
GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GA.
A COST-BENEFIT ASSESSMENT IS AN ESSENTIAL PART OF THE ENVIRONMENTAL IMPACT STATEMENT SUBMITTED AS PART OF THE LICENSING CONSIDERATIONS FOR A NUCLEAR FACILITY. SUCH AN ASSESSMENT FORMS PART OF THE INITIAL DECISION TO BUILD A NUCLEAR FACILITY, ENTERS CRITICALLY INTO THE SELECTION OF A SUITABLE SITE, AND ULTIMATELY FORMS PART OF THE DESIGN PROCEDURES TO OPTIMIZE ENGINEERING SOLUTIONS TO DEAL WITH WASTE-HEAT DISSIPATION, TREATMENT METHODS FOR RADIOACTIVE EFFLUENT CONTROL, AND LAND AND SITE USE, WHEREAS THE INITIAL DECISION USUALLY CAN BE MADE IN PURELY ECONOMIC TERMS, THE LATTER STAGES INVOLVE ENVIRONMENTAL AND SOCIAL ISSUES THAT ARE NOT READILY QUANTIFIED AND INVOLVE A QUALITATIVE JUDGMENT OF WHAT CONSTITUTES THE LEAST, READILY ACHIEVABLE IMPACT. THE RADIOLOGICAL IMPACT OF THE PLANT ON THE SURROUNDING POPULATION FROM THE RELEASE OF LOW LEVEL EFFLUENTS CAN BE QUANTIFIED AND TREATED AS A FINANCIAL 'COST.' ALTERNATIVELY IT CAN BE TREATED AS A 'RISK' AND RELATED TO OTHER RISKS MODERN MAN IS SUBJECTED TO AND CAN BE USED AS A MEANS TO ESTABLISH SITE BOUNDARIES. BOTH COST-BENEFIT AND RISK-BENEFIT ANALYSES REPRESENT ESSENTIALLY OPTIMIZATION APPROACHES TO THE PROBLEM OF MAKING NUCLEAR POWER PLANTS ECONOMICALLY COMPETITIVE, SOCIALLY AND POLITICALLY ACCEPTABLE, AND AS SAFE OR INNOCUOUS AS ONE CAN REASONABLY MAKE THEM.

17-5-1-539 CRITICAL MASS - POLITICS, TECHNOLOGY, AND THE PUBLIC INTEREST
BRONFMAN, L. M. + HATTINGLY, T. J., JR.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
CRITICAL MASS '74 AND '75, NATIONAL CONFERENCES OF OPPONENTS OF NUCLEAR POWER CONVENED BY CONSUMER ACTIVIST RALPH NADER, WERE HELD IN WASHINGTON, D.C., IN MID-NOVEMBER 1974 AND 1975. SESSIONS OF THESE CONFERENCES WERE DEVOTED TO MAKING THE CASE AGAINST NUCLEAR POWER DEVELOPMENT IN THE UNITED STATES AND ABROAD AS WELL AS TO DELINEATING STRATEGIES FOR CITIZEN ACTION AGAINST THE NUCLEAR ALTERNATIVE. THE CONFERENCES POINTED OUT

THE BROADENING OF OPPONENTS' CONCERNS FROM MERELY TECHNICAL ISSUES TO A WIDE SPECTRUM OF SOCIAL, ECONOMIC, POLITICAL, AND MORAL ISSUES. THE AUTHORS, SOCIAL SCIENTISTS AT THE OAK RIDGE NATIONAL LABORATORY, DISCUSS THE IMPLICATIONS OF THIS BROADENING DEBATE FOR ENERGY POLICY.

17-9-2-559 THE ROLE OF CORE DISRUPTIVE ACCIDENTS IN DESIGN AND LICENSING OF LMFBRS
FAUSKE, H. K.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILL.
THE ROLE OF CORE DISRUPTIVE ACCIDENTS (CDAS) IN DESIGN AND LICENSING OF LIQUID METAL COOLED FAST BREEDER REACTORS IS REVIEWED, INCLUDING A DESCRIPTION OF CDA INITIATORS, LIKELY ACCIDENT PATHS, CORE MELTDOWN ENERGETICS, AND RADIOLOGICAL CONSEQUENCES. IT IS CONCLUDED THAT (1) THE PROBABILITIES OF INITIATORS LEADING TO CORE MELTDOWN SHOULD AND CAN BE MADE SUFFICIENTLY LOW (OBJECTIVE, LESS THAN 10(EXP-6) PER REACTOR YEAR) TO REDUCE THEM TO CLASS 9 ACCIDENTS, (2) BEST ESTIMATE ANALYSES INCLUDING DESIGN CONSIDERATIONS SHOULD AND CAN DEMONSTRATE THE UNLIKELIHOOD (OBJECTIVE, LESS THAN 10(EXP-2) OF A POSTULATED CORE MELTDOWN LEADING TO SUBSTANTIAL ENERGETICS THAT WOULD CHALLENGE THE ENERGY ABSORPTION CAPABILITY PROVIDED BY THE PRIMARY SYSTEM DESIGN, I.E., THE ABSENCE OF ENERGETIC HYDRODYNAMIC DISASSEMBLY AND/OR ENERGETIC FUEL COOLANT INTERACTIONS, (3) THE PRINCIPAL BASIS FOR THE PRIMARY SYSTEM DESIGN SHOULD BE SET BY FUNCTIONAL REQUIREMENTS WHERE ANY WEAK LINKS IN THE RESULTING DESIGN SHOULD BE UPGRADED TO GIVE AN OVERALL CONSISTENT SYSTEM WITH AN OPTIMUM ENERGY ABSORPTION CAPABILITY (ESSENTIALLY CURRENT PRACTICE) AND NOT BY ARBITRARY CDA ENERGETICS, AND (4) ON THE BASIS OF BEST ESTIMATE ANALYSIS INCLUDING DESIGN CONSIDERATIONS, THE OBJECTIVE SHOULD AND CAN BE TO DEMONSTRATE LONG-TERM CONTAINMENT CAPABILITY OF THE FUEL DEBRIS FOLLOWING A POSTULATED CORE MELTDOWN ACCIDENT. THIS BALANCED APPROACH IS BELIEVED NECESSARY, AT LEAST IN THE NEAR TERM, TO ADEQUATELY DEMONSTRATE THAT THE SAFETY OBJECTIVE THAT THE OCCURRENCE OF RADIOLOGICAL CONSEQUENCES OUTSIDE THE PLANT BOUNDARY IN EXCESS OF ACCEPTABLE LEVELS MUST BE LESS THAN 10(EXP-6) PER REACTOR YEAR HAS INDEED BEEN ACHIEVED.

17-5-4-563 RELIABILIABILITY OF PIPING IN LIGHT WATER REACTORS
BUSH, S. H.
BATTELLE PACIFIC NORTHWEST LABORATORIES, RICHLAND, WASH.
THIS ARTICLE ASSESSES THE RELIABILITY OF PIPING IN LIGHT WATER REACTORS BASED ON NONNUCLEAR FAILURE DATA, CONDITIONAL FAILURE PROBABILITIES, THE ROLE OF PERIODIC INSPECTION, AND A REVIEW OF NUCLEAR SYSTEM FAILURES. FAILURE STATISTICS CONFIRM RATES OF 10(EXP-4) TO 10(EXP-6) PER REACTOR YEAR IN LARGE PIPES, WITH HIGHER RATES AS THE SIZE DECREASES. PERIODIC INSPECTION, A CRITICAL FACTOR, ENHANCES RELIABILITY BY FACTORS OF 10 TO 10,000. NUCLEAR FAILURES ARE CLASSED INTO TWO STATISTICAL CATEGORIES (1) THOSE DUE TO INTERGRANULAR STRESS CORROSION CRACKING (IGSCC), AND (2) ALL OTHERS DUE TO CONSTRUCTION, DESIGN, OR OPERATIONAL ERRORS. THE SPECTRUM OF PIPE SIZES INFLUENCED BY IGSCC DIFFERS FROM THAT INFLUENCED BY OTHER MECHANISMS.

17-5-5-580 THE ENVIRONMENTAL IMPACT OF CARBON-14 RELEASED BY A NUCLEAR FUEL REPROCESSING PLANT
VELURI, V. R. + BOONE, F. W. + PALMS, J. M.
EMORY UNIVERSITY, ATLANTA, GA.
THE ENVIRONMENTAL IMPACT OF THE PREDICTED CARBON-14 RELEASE BY THE BARNWELL NUCLEAR FUEL PLANT (BNFP) IS ASSESSED. THE EXTERNAL DOSE AND THE WHOLE-BODY DOSES DUE TO INHALATION AND INGESTION OF CARBON-14 ARE CALCULATED. FOR A PREDICTED RELEASE OF 1065 CI/YEAR, THE EXTERNAL DOSE RATE AT THE SITE BOUNDARY IS 2.9 X 10(EXP-4) MREM/YEAR, THE WHOLE-BODY INHALATION DOSE RATE IS 7.0 X 10(EXP-5) MREM/YEAR, AND THE WHOLE BODY DOSE RATE VIA INGESTION OF FOOD MATERIALS IS 0.28 MREM/YEAR. THESE RATES COMPARE WITH AN AVERAGE ANNUAL DOSE RATE PER PERSON OF 135 MREMS/YEAR DUE TO NATURAL BACKGROUND RADIATION. THE LONG TERM ASPECTS OF GLOBAL RELEASES OF CARBON-14 FROM THE NUCLEAR INDUSTRY ARE BRIEFLY DISCUSSED. THE 25-YEAR DOSE COMMITMENT TO A PERSON DUE TO CARBON-14 DISCHARGES FROM THE TOTAL WORLD NUCLEAR FACILITIES DURING THE PERIOD 1975 TO 2000 IS ESTIMATED TO BE APPROXIMATELY 1.4 MREMS, DURING THE SAME 25-YEAR PERIOD, THE BNFP CONTRIBUTION WILL BE APPROXIMATELY 0.02 MREM OF THE 1.4 MREMS. THE DOSE COMMITMENT TO A PERSON FOR THE ESTIMATED 40-YEAR LIFETIME OF BNFP WILL BE APPROXIMATELY 0.08 MREM.

17-5-6-592 BROWNS FERRY NUCLEAR POWER PLANT FIRE ON MAR.22,1975
SCOTT, R. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE REVIEWS THE MAR. 22, 1975, FIRE AT THE BROWNS FERRY NUCLEAR POWER PLANT. THE FIRE ORIGINATED IN THE ELECTRICAL CABLE TRAYS AND BURNED FOR 7 HR BEFORE IT WAS EXTINGUISHED BY WATER. THE USE OF WATER WAS DELAYED UNTIL THE REACTORS WERE IN A STABLE SHUTDOWN CONDITION BECAUSE OF THE POSSIBILITY OF SHORTING CIRCUITS, WHICH MIGHT HAVE CAUSED FURTHER DEGRADATION OF CONDITIONS THAT WOULD HAVE BEEN MORE DIFFICULT TO CONTROL. HOWEVER, WHEN WATER WAS AUTHORIZED, THE FIRE WAS QUICKLY EXTINGUISHED. THE FIRE-FIGHTING EFFORTS AND THE DAMAGE CAUSED BY THE FIRE ARE DESCRIBED. THE LOSS OF ELECTRICAL POWER AND CONTROL CIRCUITS RESULTED IN THE UNAVAILABILITY OF EMERGENCY CORE COOLING SYSTEMS AND HAMPERED

EFFORTS TO PROVIDE NORMAL COOLING TO THE REACTOR FUEL. THE AVAILABILITY OF ALTERNATE COOLING METHODS IS REVIEWED. THE EFFORTS TO MAINTAIN COOLING OF THE REACTOR FUEL ARE DISCUSSED, AND THE BASIC REASONS FOR THE COMMON-MODE FAILURES ARE DESCRIBED. ASSESSMENTS OF THE FIRE WERE MADE BY THREE GROUPS IN THE U.S. NUCLEAR REGULATORY COMMISSION (NRC), AS WELL AS BY AN INDEPENDENT INSURANCE GROUP. SOME OF THE DETAILS OF THESE ASSESSMENTS ARE PRESENTED. IN PARTICULAR, SOME DEFICIENCIES THAT THE NRC OFFICE OF INSPECTION AND ENFORCEMENT FOUND DURING ITS INVESTIGATION AND SOME OF THE LESSONS LEARNED FROM THE EVENTS AS DETERMINED BY THE NRC SPECIAL REVIEW GROUP.

17-5-6-622 OCCUPATIONAL RADIATION EXPOSURES AT LWRS, 1969-1974
MURPHY, T. D. + HINSON, C. S.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THIS ARTICLE SUMMARIZES A REPORT BY THE NUCLEAR REGULATORY COMMISSION WHICH PRESENTS COMPILATIONS OF OCCUPATIONAL RADIATION EXPOSURES AT COMMERCIAL LIGHT WATER COOLED POWER REACTORS FROM 1969 TO 1974. THE EXPOSURE IN MAN REMS PER UNIT FOR ALL REACTORS IN 1974 WAS LESS THAN THE 1973 VALUE, BUT THE GRAND AVERAGE SINCE 1969 CONTINUED TO INCREASE. HOWEVER, NO SIGNIFICANT TREND WAS INDICATED. OVER THE PERIOD 1969-1974, IN THE MEAN VALUE OF MAN REMS PER MEGAWATT YEAR.

17-6-1-659 ESTIMATES OF THREATS TO THE PUBLIC FROM TERRORIST ACTS AGAINST NUCLEAR FACILITIES
CHESTER, C. V.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE POTENTIAL FATALITIES, OR EXTENT OF POTENTIAL LETHAL CONSEQUENCES, FROM TERRORIST ACTS AGAINST NUCLEAR FACILITIES ARE ESTIMATED. THE MOST SEVERE THREAT IS FROM THEFT OF FISSIONABLE MATERIAL AND SUBSEQUENT FABRICATION OF A CLANDESTINE NUCLEAR EXPLOSIVE. A NUCLEAR EXPLOSIVE OF EFFICIENT DESIGN EXPLODED WITHOUT WARNING IN A CROWDED HIGH RISE COMMERCIAL DISTRICT COULD PRODUCE OVER A MILLION FATALITIES. THE UNCONTAINED MELTDOWN OF A POWER REACTOR AND, TO A LESSER EXTENT, THE DISPERSAL OF PLUTONIUM ARE MINOR THREATS TO HUMAN LIFE IF THERE IS ANY WARNING, BUT THEY ARE POTENTIALLY LARGE AND VERY COERCIVE THREATS TO PROPERTY. THE TOXICITY OF PLUTONIUM IS NO WORSE THAN THAT OF THE MUCH MORE EASILY AVAILABLE NERVE GAS AND REQUIRES WEEKS OR MONTHS TO KILL AS OPPOSED TO MINUTES FOR NERVE GAS. ATTACKS ON SPENT FUEL SHIPMENTS, HIGH LEVEL WASTE SHIPMENTS, REPROCESSING PLANTS, OR WASTE TANKS PRESENT MINIMAL THREATS TO HUMAN LIFE.

17-6-1-665 SAFETY AND SECURITY OF NUCLEAR POWER REACTORS TO ACTS OF SABOTAGE
SANDIA STAFF
SANDIA LABORATORIES, ALBUQUERQUE, N.MEX., AND LIVERMORE, CALIF.
A STUDY HAS BEEN MADE OF THE VULNERABILITY OF U.S. COMMERCIAL LIGHT WATER REACTOR POWER PLANTS TO SABOTAGE. THE SUSCEPTIBILITY OF NUCLEAR PLANTS TO SABOTAGE AND THE CONSEQUENCES OF A SUCCESSFUL ATTACK ARE COMPARED WITH RESPECT TO OTHER INDUSTRIAL AND CIVIL TARGETS. RECOMMENDATIONS ARE GIVEN TO FURTHER REDUCE THE VULNERABILITY OF NUCLEAR POWER PLANTS TO SOPHISTICATED SABOTAGE THREATS.

17-6-2-671 DATA SOURCES FOR LOCA CODE VERIFICATION
FABIC, S.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
MATHEMATICAL MODELS IN THE CURRENT AND ADVANCED LOSS OF COOLANT ACCIDENT CODES UNDER DEVELOPMENT ARE CATEGORIZED, AND INDICATIONS ARE GIVEN OF THE DEPENDENT VARIABLES THAT COULD BE SOLVED FOR AND OF THE NUMBER AND TYPE OF CONSTITUTIVE EQUATIONS THAT NEED TO BE VERIFIED. TEST DATA SOURCES ARE CLASSIFIED ACCORDING TO THE COMPLEXITY AND DIVERSITY OF MEASUREMENTS. EXISTING DATA SOURCES, BOTH DOMESTIC AND FOREIGN, ARE LISTED FOR EACH CLASS OF TESTS. ADDITIONAL TEST DATA NEEDS ARE OUTLINED, FOLLOWED BY A DESCRIPTION OF THE EXISTING PLANS FOR CODE VALIDATION AND FOR UNCERTAINTY STUDIES ON CODE RESULTS. THE CONCLUSION IS REACHED THAT THERE IS AN EXTENSIVE DATA BASE AVAILABLE FOR CODE VERIFICATION, EXCEPT FOR THOSE BEST ESTIMATE CODES WHICH MODEL MULTIDIMENSIONAL EFFECTS AND THE LOCAL EFFECTS OF INTERPHASE MASS, MOMENTUM, AND ENERGY TRANSFER. THE NUCLEAR REGULATORY COMMISSION IS IN THE PROCESS OF CONTRACTING FOR THE ADDITIONAL RESEARCH REQUIRED TO SUPPLEMENT THE EXISTING DATA BASE.

17-6-3-686 COMMON-MODE FAILURE MECHANISMS IN REDUNDANT SYSTEMS IMPORTANT TO REACTOR SAFETY
HAYDEN, K. C. + HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A BROAD CATEGORY OF FAILURE MECHANISMS THAT CAN CAUSE COMMON-MODE FAILURES IN NUCLEAR PLANT REDUNDANT SYSTEMS AND OTHER HIGH RELIABILITY SYSTEMS IS EXAMINED. THIS CLASS OF MECHANISMS INCLUDES CAUSES OF MULTIPLE FAILURES THAT HAVE NOT BEEN WIDELY RECOGNIZED AS COMMON-MODE FAILURES IN THE PAST. FAILURE MECHANISMS WERE DEDUCED FROM REACTOR OPERATING EXPERIENCES AND REPORTS. SEVERAL CATEGORIES OF MULTIPLE FAILURE MECHANISMS ARE PROPOSED AS A STARTING POINT FOR THE DEVELOPMENT OF DESIGN AND OPERATING GUIDELINES FOR REDUCING THE PROBABILITY OF COMMON-MODE FAILURES.

17-6-3-693 SAFETY EVALUATION EXPERIENCE WITH DIGITAL COMPUTER SOFTWARE
BELTRACCHI, L. + BULLOCK, J. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE USE OF DIGITAL COMPUTERS IN REACTOR PROTECTION SYSTEMS PRESENTS NEW CONSIDERATIONS FOR THE DESIGNERS OF BOTH THE REACTOR AND THE SAFETY SYSTEM. THIS ARTICLE DISCUSSES EXPERIENCES IN THE SAFETY EVALUATION OF PROTECTION SYSTEM SOFTWARE IN TERMS OF DEVELOPED GUIDELINES. THE IMPORTANCE OF THE SOFTWARE DEVELOPMENT CYCLE, AND THE APPLICATION OF THE GUIDELINES. IMPORTANT GUIDELINES SUCH AS CRITICAL DESIGN FAULTS AND QUALITATIVE RELIABILITY ARE CURRENTLY BEING USED FOR EVALUATION PURPOSES, AND MINIMUM REQUIREMENTS FOR THE DESIGN QUALIFICATION AND ACCEPTANCE TESTING OF THE SOFTWARE HAVE BEEN IDENTIFIED. ALTHOUGH THE SAFETY REVIEW IS INCOMPLETE, MOST OF THE PROTECTION ALGORITHMS, TEST PLANS, AND SOME TEST RESULTS HAVE BEEN REVIEWED. OUR EXPERIENCES TO DATE MAY PROVE FRUITFUL FOR OTHERS CONTEMPLATING THE DEVELOPMENT AND REVIEW OF SOFTWARE IN SAFETY RELATED SYSTEMS. THE OPINIONS EXPRESSED HEREIN REFLECT THE CURRENT EXPERIENCE OF THE AUTHORS. FINAL REGULATORY GUIDANCE OF THE NUCLEAR REGULATORY COMMISSION HAS NOT BEEN DEVELOPED.

17-6-4-701 EMERGENCY SHUTDOWN COOLING TOWERS - CONSIDERATIONS IN THE EVOLUTION OF OPTIMUM TOWER DESIGN
KLEIN, S. M.
UNITED ENGINEERS + CONSTRUCTORS INC., PHILADELPHIA, PA.
THIS ARTICLE DISCUSSES THE VARIOUS REGULATORY REQUIREMENTS AND CRITERIA GOVERNING THE DESIGN OF EMERGENCY SHUTDOWN COOLING TOWERS FOR NUCLEAR POWER PLANTS. THE EFFECTS OF KEY TOWER PARAMETERS (E.G., WET BULB TEMPERATURE, FLOW RATES, AND HEAT LOAD) ON TOWER SIZE AND THEIR INTERACTIONS WITH SYSTEM AND SAFETY REQUIREMENTS ARE EXPLORED. THE EVOLUTION OF THE SEABROOK STATION TOWER AND ITS RELATIONSHIP TO A COMPANION COOLING WATER SOURCE (THE ATLANTIC OCEAN) ARE PRESENTED AS AN EXAMPLE OF OPTIMUM TOWER / SYSTEM DESIGN THAT COMPLIES WITH REGULATORY REQUIREMENTS.

17-6-4-710 THE ICE CONDENSER SYSTEM FOR CONTAINMENT PRESSURE SUPPRESSION
LIPARULO, N. J. + TINKLER, C. C. + GEORGE, J. A.
WESTINGHOUSE ELECTRIC CORPORATION, PITTSBURGH, PA.
THIS ARTICLE DESCRIBES THE WESTINGHOUSE ICE CONDENSER SYSTEM FOR SUPPRESSING PRESSURE CAUSED BY THE RELEASE OF STEAM WITHIN THE CONTAINMENT SYSTEM OF A POWER REACTOR. THE BASIC CONCEPT, SYSTEM CHARACTERISTICS, CONTAINMENT LAYOUT, AND SIZE ARE PRESENTED, AND THE TEST PROGRAM FOR ICE CONDENSER HEAT TRANSFER AND A TYPICAL RESPONSE TO A LOSS OF COOLANT ACCIDENT ARE DESCRIBED.

17-6-5-722 RADIOLOGICAL ASPECTS OF INACTIVE URANIUM MILLING SITES - AN OVERVIEW
GOLDSMITH, W. A.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
RADIOACTIVE RESIDUES - CALLED TAILINGS - OF DISCONTINUED URANIUM MILLING OPERATIONS ARE PRESENT AT 23 LOCATIONS IN THE WESTERN UNITED STATES. THE SHORT LIVED PROGENY OF THE RADON-222 EMANATING FROM THE TAILINGS GIVES RISE TO MOST OF THE PUBLIC RADIATION EXPOSURE RESULTING FROM PRESENT MANAGEMENT OF THESE TAILINGS. SINCE PRECURSORS OF RADON-222 HAVE EXTREMELY LONG HALF LIVES, LONG TERM MANAGEMENT POLICIES AND TECHNIQUES ARE REQUIRED IF FURTHER REDUCTION OF RADIATION EXPOSURE TO THE PUBLIC IS DESIRED.

17-6-6-733 IN-SERVICE INSPECTION OF NUCLEAR POWER PLANT PRESSURE COMPONENTS
LAUTZENHEISER, C. E.
SOUTHWEST RESEARCH INSTITUTE, SAN ANTONIA, TEXAS
THE EARLY LIGHT WATER REACTOR SYSTEMS FOR PRODUCTION OF COMMERCIAL POWER WERE DESIGNED AND FABRICATED IN ACCORDANCE WITH THE CODES THEN BEING USED FOR FOSSIL FIRED POWER GENERATING STATIONS WITH SOME DESIGN CHANGES FOR INCREASED INSPECTABILITY DURING FABRICATION. OVER THE PAST FEW YEARS, MAJOR STRIDES HAVE BEEN MADE IN IN-SERVICE INSPECTION TECHNOLOGY. WORK HAS BEEN UNDER WAY TO DETERMINE THE RELIABILITY OF NONDESTRUCTIVE TESTING METHODS AND TO DEVELOP FORMAL INSPECTION PROGRAMS THROUGHOUT THE WORLD. THE MAJOR PROBLEMS ASSOCIATED WITH IN-SERVICE INSPECTION ARE THE SCARCITY OF QUALIFIED PERSONNEL, THE VARIABILITY IN PROCEDURES AND DATA RECORDING BETWEEN INSPECTION AGENCIES, AND EXPOSURE OF INSPECTION PERSONNEL TO RADIATION. FURTHER WORK WILL BE REQUIRED TO MORE COMPLETELY MECHANIZE PIPING INSPECTIONS TO REDUCE RADIATION EXPOSURE AND TO STANDARDIZE INSPECTION PROCEDURES, EQUIPMENT, AND CERTIFICATION OF PERSONNEL. WORLDWIDE ATTENTION TO THE REQUIREMENTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS' BOILER AND PRESSURE VESSEL CODE, THE SIZE AND INTEGRITY OF INSPECTION AGENCIES, AND EFFORTS SUCH AS THE DEVELOPMENT OF PERSONNEL QUALIFICATION AND CERTIFICATION GUIDES EMPHASIZE THE IMPORTANCE OF IN-SERVICE INSPECTION TO NUCLEAR SAFETY.

17-6-6-743 OCCUPATIONAL RADIATION EXPOSURES AT LICENSED FACILITIES, 1974
BROOKS, B. G.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
PERSONNEL OCCUPATIONAL RADIATION EXPOSURES FOR CALENDAR YEAR 1974 WERE OBTAINED FROM ANNUAL AND TERMINATION REPORTS SUBMITTED BY CERTAIN TYPES OF AEC LICENSEES, I.E., OPERATING

NUCLEAR POWER FACILITIES, INDUSTRIAL RADIOGRAPHERS, FUEL PROCESSORS, FABRICATORS, AND REPROCESSORS, COMMERCIAL PROCESSORS, AND DISTRIBUTORS OF SPECIFIED QUANTITIES OF BY-PRODUCT MATERIALS. THESE DATA ARE PRESENTED IN A NUCLEAR REGULATORY COMMISSION REPORT, WHICH IS SUMMARIZED HERE. REPORTS FROM 421 LICENSEES INDICATED THAT 85,097 INDIVIDUALS WERE MONITORED FOR EXPOSURE TO RADIATION DURING 1974 AND THAT 17,627 INDIVIDUALS TERMINATED THEIR EMPLOYMENT OR WORK ASSIGNMENT WITH LICENSEES IN 1974. BOTH FIGURES SHOW AN INCREASE OF ABOUT 23 PERCENT OVER THOSE OF 1973. DESPITE THE INCREASE IN THE NUMBER OF INDIVIDUALS MONITORED DURING THE 7 YEARS, THE NUMBER OF THE MORE SIGNIFICANT EXPOSURES HAS REMAINED FAIRLY CONSTANT.

18-1-1-1 NRC WATER REACTOR SAFETY RESEARCH PROGRAM
TONG, L. S. + BENNETT, G. L.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE WATER REACTOR SAFETY RESEARCH PROGRAM OF THE NUCLEAR REGULATORY COMMISSION IS DESCRIBED, AND THE BASIC RESULTS ARE PRESENTED. THE PROGRAM CONSISTS OF FIVE BASIC RESEARCH AREAS - INTEGRITY OF VESSEL AND PIPING, THERMAL HYDRAULIC TESTS, FUEL ROD BEHAVIOR, CODE DEVELOPMENT AND VERIFICATION, AND REACTOR OPERATIONAL SAFETY. RESULTS FROM THE VESSEL AND PIPING INTEGRITY RESEARCH HAVE DEMONSTRATED THE HIGH SAFETY MARGINS IN SCALED VESSELS AND THE ANALYTICAL PROCEDURES FOR CALCULATING VESSEL BEHAVIOR UNDER PRESSURE. NONDESTRUCTIVE EXAMINATION TECHNIQUES ARE BEING IMPROVED. WORK IS ALSO PROCEEDING TO DEFINE THE MATERIAL CONSTITUENTS WITH WHICH TO REDUCE THE SUSCEPTIBILITY OF COMPONENTS AND STRUCTURES TO IRRADIATION EMBRITTLEMENT AND STRESS CORROSION CRACKING. THE THERMAL HYDRAULIC TESTS HAVE COVERED THE VARIOUS PHASES OF A HYPOTHETICAL LOSS OF COOLANT ACCIDENT AND ACTIVATION OF THE EMERGENCY CORE COOLING SYSTEM. THESE TESTS HAVE LED TO THE DEVELOPMENT OF MORE REALISTIC ENGINEERING CORRELATIONS TO DESCRIBE THE PHENOMENA IN ORDER TO FURTHER QUANTIFY THE SAFETY MARGINS IN COMMERCIAL NUCLEAR POWER PLANTS. THE FUEL BEHAVIOR RESEARCH HAS PROVIDED VALUABLE INFORMATION ON DECAY HEAT, CLADDING OXIDATION, FUEL ROD BEHAVIOR, AND FUEL MELTING. BOTH THE DECAY HEAT AND THE CLADDING OXIDATION HAVE BEEN SHOWN TO BE LOWER THAN ASSUMED IN THE LICENSING EVALUATIONS. THE REACTOR OPERATIONAL SAFETY RESEARCH IS JUST STARTING - INITIALLY IT ADDRESSES FIRE PROTECTION, COMPONENT AGING, AND HUMAN ENGINEERING. TO DATE, THE NRC WATER REACTOR SAFETY RESEARCH PROGRAM HAS GREATLY EXPANDED THE SAFETY DATA BASE, WHICH IN TURN IS USED FOR FURTHER QUANTIFICATION OF THE INHERENT SAFETY MARGINS IN NUCLEAR POWER PLANTS.

18-1-2-45 REFLECTIONS ON THE RECRITICALITY CONFERENCE AT ARGONNE NATIONAL LABORATORY
GRIFFITH, J. D.
U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, WASHINGTON, D.C.
THE CONSENSUS OF THE RECRITICALITY CONFERENCE AT ARGONNE NATIONAL LABORATORY WAS THAT THE ENERGETIC RECRITICALITY ACCIDENT IS A HIGHLY IMPROBABLE EVENT BUT THAT PROOF OF ITS IMPOSSIBILITY IS NOT YET FULLY CONVINCING TO THE INTERESTED SCIENTIFIC COMMUNITY. THE AUTHOR EXTENDS THE DISCUSSION AND SUGGESTS THAT AN ENDLESS EFFORT TO ESTABLISH THE EXISTENCE OF VERY LOW PROBABILITY EVENTS OR TO PROVE THE IMPOSSIBILITY OF SOME POSTULATED EVENTS WOULD BE A FRUITLESS ENDEAVOR. IT IS CONCLUDED THAT THE EMPHASIS SHOULD BE SHIFTED FROM A SEARCH FOR GREATER ASSURANCE OF THE NONEXISTENCE OF LOW PROBABILITY EVENTS TO THE UNDERSTANDING OF REAL PHENOMENA AT THE VARIOUS NATURAL LINES OF ASSURANCE THAT EXIST FOR A LIQUID METAL COOLED FAST BREEDER REACTOR. THE AUTHOR PROPOSES THAT THIS BE DONE WITH AN APPROPRIATE RISK CURVE INCORPORATING THE LINES OF ASSURANCE AND A PROPOSED CRITERION. THE CRITERION PROPOSED IS THAT PHENOMENA THAT CAN BE MADE TO OCCUR EXPERIMENTALLY UNDER REALISTIC REACTOR CONDITIONS BE STUDIED AND UNDERSTOOD AND PHENOMENA THAT CANNOT BE MADE TO HAPPEN EXPERIMENTALLY BE ASSUMED TO HAVE A PROBABILITY OF OCCURRENCE LOWER BY A FACTOR OF 10(EXP-2) TO 10(EXP-3) AND THE CONSEQUENCES OF THESE LOWER-PROBABILITY EVENTS BE STUDIED AT THE NEXT LINE OF ASSURANCE.

18-1-3-53 LOSS OF ELECTRIC POWER COINCIDENT WITH LOCA
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE ANALYSIS CONDUCTED IN THE REACTOR SAFETY STUDY (WASH-1400) PRESENTS A METHOD FOR ESTABLISHING A RISK PROBABILITY FOR POSTULATED ACCIDENT CIRCUMSTANCES. SINCE THESE PROBABILITIES PROVIDE A MEANS FOR PLACING EVENTS INTO A RELATIVE PERSPECTIVE, THE EDITOR HAS PREPARED THAT PORTION OF THE STUDY CONCERNED WITH AND ENTITLED 'TOTAL LOSS OF ELECTRIC POWER' FOR REPUBLICATION HERE FOR A BROADER AUDIENCE. THE STUDY CONCLUDED THAT THE PROBABILITY OF THE TOTAL LOSS OF ELECTRIC POWER WAS 10(EXP-5) AT THE TIME OF A LOSS OF COOLANT ACCIDENT (LOCA) AND RANGED FROM ABOUT 10(EXP-4) TO 10(EXP-8) FOR VARIOUS TIMES AND CONFIDENCE LEVELS FOLLOWING A LOCA. THE 'EDITOR'S POSTSCRIPT' TO THIS EDITED VERSION OF THE RISK ASSESSMENT ANALYSIS IS A STATEMENT OF THE PRIMARY PURPOSE AND FUNCTION OF THE TWO ELECTRIC POWER SYSTEMS ASSOCIATED WITH NUCLEAR POWER PLANTS. SOME ACTUAL PLANT OPERATING DATA AND BLACKOUT EXPERIENCES ARE PRESENTED FOR RELEVANCE AND TO SUPPLEMENT THE LIMITED DATA BASE

CHOSEN FOR THE STUDY. THE REFERENCE LIST GIVEN IN THE REPORT IS ALSO INCLUDED AND IS SUPPLEMENTED BY REFERENCES THAT ARE CITED IN THE POSTSCRIPT. A SHORT BIBLIOGRAPHY IS APPENDED.

18-1-4-60 PHENOMENOLOGICAL INVESTIGATION OF POSTULATED MELTDOWN ACCIDENTS IN LIGHT WATER REACTORS
DISALVO, R.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
RENEWED INTEREST HAS RECENTLY DEVELOPED IN ANALYZING THE COURSE AND CONSEQUENCES OF HIGHLY IMPROBABLE, HYPOTHETICAL ACCIDENTS THAT INVOLVE MELTING OF A SIGNIFICANT PORTION OF THE FUEL IN LIGHT WATER REACTORS. PHYSICAL PHENOMENA ASSOCIATED WITH SUCH ACCIDENTS AND CURRENT TRENDS IN SAFETY RESEARCH APPLICABLE TO THEIR ANALYSIS ARE REVIEWED. THE OBJECTIVES, TECHNICAL APPROACHES, AND RECENT FINDINGS OF SELECTED PROGRAMS IN THE UNITED STATES AND THE FEDERAL REPUBLIC OF GERMANY ARE SUMMARIZED.

18-1-6-79 RADIOACTIVE MATERIAL RELEASED FROM NUCLEAR POWER PLANTS IN 1974
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
MEASURED RELEASES OF RADIOACTIVE MATERIALS IN AIRBORNE AND LIQUID EFFLUENTS AND SOLID WASTE FROM NUCLEAR POWER PLANTS DURING 1974 ARE SUMMARIZED AND COMPARED TO FORMER YEARS. THIS REPORT SUPPLEMENTS THE EARLIER ANNUAL REPORTS ISSUED BY THE ATOMIC ENERGY COMMISSION AND THE NUCLEAR REGULATORY COMMISSION. ALTHOUGH THE 1974 RELEASES WERE IN ALL CASES BELOW THE LIMITS SET FORTH IN APPLICABLE REGULATIONS, THE AIRBORNE EFFLUENTS INCREASED ABOUT 2 PERCENT AND THE LIQUID EFFLUENTS DECREASED ABOUT 6 PERCENT IN 1974 AS COMPARED TO 1973.

14-2-1-127 LEGAL AND INSTITUTIONAL PROBLEMS IN POWER PLANT SITING
BORKO, B. + JUST, J. E.
MITRE CORPORATION, MCLEAN, VA.
UNCERTAIN LONG RANGE DEMAND, RISING POWER PLANT CAPITAL AND OPERATING COSTS, INCREASING CONSTRUCTION TIME, AND THE IMPOSITION OF MORE STRINGENT REGULATORY REQUIREMENTS FOR NEW POWER PLANTS HAVE RESULTED IN AN INCREASINGLY COMPLEX PROCESS FOR SITING NEW ELECTRIC GENERATING CAPACITY. MAJOR LEGAL AND INSTITUTIONAL IMPEDIMENTS TO A MORE EXPEDITIOUS SITING PROCESS INCLUDE THE NEED FOR ENUNCIATED NATIONAL STRATEGIES ON SUCH ISSUES AS SAFETY STANDARDS, THE NUCLEAR FUEL CYCLE, AND COMMITMENT TO CONSERVATION, THE LACK OF A DEFINITIVE MECHANISM ASSIGNING SPECIFIC RESPONSIBILITY FOR SITE SELECTION, AND THE FACT THAT PUBLIC ACCESS TO SITING DECISIONS IS FIRST PROVIDED AT A LATE STAGE IN THE DECISION PROCESS.

13-2-1-133 FOURTH WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE IS A REVIEW OF THE FOURTH WATER REACTOR SAFETY RESEARCH INFORMATION MEETING, SPONSORED BY THE NUCLEAR REGULATORY COMMISSION'S (NRC'S) DIVISION OF REACTOR SAFETY RESEARCH, HELD AT THE NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD., SEPT. 27-30, 1976. THIS MEETING CONSISTED OF PARALLEL TECHNICAL PRESENTATIONS IN THE MORNING, FOLLOWED BY SEVERAL SMALLER WORKSHOPS OR DISCUSSION SESSIONS IN THE AFTERNOON. THE TECHNICAL SESSIONS WERE (1) LOSS OF COOLANT ACCIDENT STUDIES, (2) ANALYSIS DEVELOPMENT PROGRAM, (3) METALLURGY AND MATERIALS RESEARCH PROGRAM, AND (4) FUEL BEHAVIOR RESEARCH PROGRAM. SUMMARIES OF THE WORK IN EACH OF THESE FOUR MAJOR AREAS ARE PRESENTED HERE. OVER 635 PERSONS, INCLUDING SOME 126 FOREIGN VISITORS FROM 14 COUNTRIES, ATTENDED THE MEETING. IN ADDITION TO THE REVIEW OF NRC-SPONSORED WATER REACTOR SAFETY RESEARCH PROGRAMS, THE MEETING INCLUDED PRESENTATIONS ON SEVERAL FOREIGN REACTOR SAFETY PROGRAMS AS WELL AS ONE AFTERNOON SESSION DEVOTED TO RESEARCH SPONSORED BY THE ELECTRIC POWER RESEARCH INSTITUTE. THE MEETING WAS NOTABLE FOR THE WEALTH OF TECHNICAL DATA AND EXPERIMENTAL RESULTS THAT WERE REPORTED, MANY TOPICS WERE DISCUSSED, AND MUCH WAS LEARNED. IT IS REASSURING THAT THESE RESEARCH RESULTS CONTINUE TO SUBSTANTIATE OUR UNDERSTANDING OF REACTOR SAFETY.

18-2-2-154 BURNOUT IN BOILING HEAT TRANSFER II. SUBCOOLED AND LOW QUALITY FORCED CONVECTION SYSTEMS
BERGLES, A. E.
IOWA STATE UNIVERSITY, AMES, IOWA
RECENT EXPERIMENTAL AND ANALYTICAL DEVELOPMENTS REGARDING BURNOUT IN SUBCOOLED AND LOW QUALITY FORCED CONVECTION SYSTEMS ARE REVIEWED. MANY DATA HAVE BEEN ACCUMULATED WHICH CLARIFY THE PARAMETRIC TRENDS AND LEAD TO NEW DESIGN CORRELATIONS FOR WATER AND A VARIETY OF OTHER COOLANTS IN BOTH SIMPLE AND COMPLEX GEOMETRIES. A NUMBER OF CRITICAL EXPERIMENTS AND MODELS HAVE BEEN DEVELOPED TO ATTEMPT TO CLARIFY THE BURNOUT MECHANISM(S) IN SIMPLER GEOMETRIES. OTHER TOPICS DISCUSSED INCLUDE BURNOUT WITH POWER TRANSIENTS AND TECHNIQUES TO AUGMENT BURNOUT.

18-2-3-164 ASSESSMENT OF A HIGH INTEGRITY PROTECTIVE SYSTEM FOR LOSS OF ELECTRIC POWER
AITKEN, A.
UNITED KINGDOM ATOMIC ENERGY AUTHORITY, GREAT BRITAIN
THIS ARTICLE OUTLINES THE PROBLEM AND THE PROBLEM AREAS AS OBSERVED IN A RECENT ASSESSMENT OF A HIGH INTEGRITY PROTECTIVE SYSTEM FOR THE PROTOTYPE FAST REACTOR, A LIQUID METAL COOLED FAST BREEDER REACTOR AT DOUNREAY. TARGETS FOR RELIABILITY IN

INDIVIDUAL MEASUREMENTS, SAFETY CIRCUITS, AND SHUTDOWN DEVICES ARE DETERMINED BY RELIABILITY APPORTIONMENT WITHIN THE DIVERSE SYSTEM THAT WAS DESIGNED TO MEET WELL-RECOGNIZED BASIC PRECEPTS. SOME COMMENTS ARE MADE ON OPERATING EXPERIENCE IN RELATION TO THE HIGH REQUIREMENTS.

18-2-4-174 THE FOURTEENTH ERDA AIR CLEANING CONFERENCE
MOELLER, D. W. + UNDERHILL, D. W. + FIRST, M. W.
HARVARD UNIVERSITY, BOSTON, MASS.
THE FOURTEENTH ERDA AIR-CLEANING CONFERENCE WAS HELD AUG. 2-4, 1976, IN SUN VALLEY, IDAHO. THE 324 ATTENDEES INCLUDED REPRESENTATIVES FROM 13 FOREIGN COUNTRIES AND AIR CLEANING SPECIALISTS FROM ESSENTIALLY ALL FACETS OF INDUSTRY, FROM GOVERNMENTAL AGENCIES, AND FROM EDUCATIONAL INSTITUTIONS. MAJOR TOPICS WERE RADIOIODINE SAMPLING, REMOVAL, AND RETENTION, THE CONCENTRATION AND STORAGE OF NOBLE GASES, TRITIUM, AND CARBON-14, PARTICULATE COLLECTORS, SYSTEMS PROTECTION FROM FIRES, EXPLOSIONS, AND NATURAL DISASTERS, SAMPLING AND MONITORING, AIR CLEANING AND VENTILATION SYSTEM DESIGN, AIR CLEANING PROBLEMS ASSOCIATED WITH THE TREATMENT OF RADIOACTIVE WASTES, AIR CLEANING SYSTEMS FOR THE LIQUID METAL CLOLED FAST BREEDER REACTOR, AND THE REGULATORY ASPECTS OF THE AIR CLEANING FIELD. AN INTERESTING ASPECT OF THE CONFERENCE WAS THE DEGREE TO WHICH PROBLEMS ASSOCIATED WITH RADIOIODINE STILL MAINTAIN A PROMINENT PLACE IN AIR CLEANING RESEARCH AND DEVELOPMENT. NEWER CHALLENGES BECAME EVIDENT FROM THE BROWNS FERRY FIRE, WHICH REVEALED WEAKNESSES IN AIR CLEANING AND VENTILATION SYSTEMS IN NUCLEAR POWER PLANTS, AND FROM THE REACTOR SAFETY STUDY, WHICH SHOWED A NEED TO DEVELOP ADDITIONAL DATA ON THE RELIABILITY OF SUCH SYSTEMS, PARTICULARLY UNDER EMERGENCY CONDITIONS. ASSESSMENTS OF THE DEGREE TO WHICH ENGINEERED SAFETY FEATURES CAN BE USED TO COMPENSATE FOR SPECIFIC DEFICIENCIES IN NUCLEAR FACILITY SITES ALSO CONTINUE TO CHALLENGE THOSE INVOLVED IN RISK-BENEFIT EVALUATIONS.

18-2-4-182 TRENDS IN THE DESIGN OF PRESSURIZED WATER REACTOR CONTAINMENT STRUCTURES AND SYSTEMS
MEHTA, D. S. + OSGOOD, H. W. + BINGAMAN, A. J.
BUCHERT, K. P.
BECHTEL POWER CORPORATION, GAITHERSBURG, MD.
THIS ARTICLE TRACES THE EVOLUTION OF PRESSURIZED WATER REACTOR (PWR) CONTAINMENT DESIGN REQUIREMENTS AND CONCEPTS SINCE THE MID-1960S. DISCUSSES THE STRUCTURES AND SYSTEMS CURRENTLY BEING USED FOR NEW PLANTS, AND PRESENTS TABULATED DATA CONCERNING SIZE AND TYPE OF CONTAINMENT STRUCTURE, INTERNAL DESIGN PRESSURE, AND SAFE SHUTDOWN GROUND ACCELERATION VALUES FOR 127 NUCLEAR POWER PLANTS. IN ADDITION, VARIOUS CONTAINMENT SYSTEMS, SUCH AS FISSION-PRODUCT REMOVAL, HEAT REMOVAL, COMBUSTIBLE GAS CONTROL, AND PURGE, ARE BRIEFLY REVIEWED.

18-2-5-203 RADIOLOGICAL AND ENVIRONMENTAL ASPECTS OF FUSION POWER
EASTERLY, C. E. + SHANK, K. E. + SHOUP, R. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
FUSION REACTOR TECHNOLOGY IS PRESENTLY IN CONCEPTUAL AND EARLY DEVELOPMENTAL STAGES, CONCOMITANT WITH HARDWARE DEVELOPMENT, POTENTIAL HEALTH AND ENVIRONMENTAL IMPACTS MUST BE EVALUATED TO ENSURE THAT TECHNOLOGISTS HAVE PERTINENT INFORMATION AVAILABLE SO THAT ADEQUATE CONSIDERATION MAY BE GIVEN TO HEALTH AND ENVIRONMENTAL PROBLEMS. THIS ARTICLE DISCUSSES PROBLEM AREAS ATTENDANT TO TRITIUM, ACTIVATION PRODUCTS, AND MAGNETIC FIELDS ASSOCIATED WITH FUSION REACTOR SYSTEMS.

18-2-5-215 RADIOLOGICAL QUALITY OF THE ENVIRONMENT
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS REPORT IS PART OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S DOSE ASSESSMENT PROGRAM FOR EVALUATING THE RADIOLOGICAL QUALITY OF THE ENVIRONMENT. ITS PUBLICATION HERE DOES NOT CONSTITUTE ENDORSEMENT OF THE ORIGINAL REPORT BY THE NUCLEAR REGULATORY COMMISSION, RATHER, THE EDITORS OF NUCLEAR SAFETY BELIEVE THE AUTHORS HAVE BROUGHT TOGETHER A WEALTH OF DATA AND EXTENSIVE REFERENCES TO THE CURRENT LITERATURE, BOTH OF WHICH SHOULD BE USEFUL TO THE GENERALIST AND SPECIALIST ALIKE. THE REPORT RECOGNIZES THE NEED FOR ADDITIONAL INFORMATION, AND THE INTERESTED READER IS URGED TO CONSULT THE ORIGINAL REPORT FOR ADDITIONAL DETAILS, QUALIFICATIONS, AND SOURCES PERTINENT TO ALL OF THE DATA. AS A PROTOTYPE EFFORT, THIS REPORT IS INTENDED ONLY TO SUMMARIZE INFORMATION AVAILABLE IN THE OPEN LITERATURE. SPECIAL EMPHASIS WAS PLACED ON ACQUIRING RECENT DOSE DATA. FOR SOME SOURCE CATEGORIES, DOSE INFORMATION WAS AVAILABLE FOR CALENDAR YEAR 1975, WHEREAS FOR OTHER CATEGORIES THE MOST RECENT DATA GO BACK TO THE EARLY 1970S. IT IS NOT INTENDED IN THIS INITIAL EFFORT TO CALCULATE OR EXTRAPOLATE FROM EXISTING DATA TO SUPPLY MISSING DOSE INFORMATION. INSTEAD, THE CONCERN IS TO REVIEW THE AVAILABLE DATA AND TO DETERMINE WHAT THE EXISTING DATA PROVIDE FOR INDIVIDUAL AND POPULATION DOSE INFORMATION. SINGLE COPIES OF THE REPORT MAY BE OBTAINED FROM THE OFFICE OF RADIATION PROGRAMS, U.S. ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C. 20460. IT WAS CONCLUDED, ON THE BASIS OF THE POPULATION DOSE DATA ACQUIRED IN THIS REPORT, THAT THE THREE MAJOR SOURCE CATEGORIES OF RADIATION DOSE IN THE U.S. POPULATION ARE (1)

AMBIENT IONIZING RADIATION. (2) THE APPLICATION OF RADIOPHARMACEUTICALS IN MEDICINE, AND (3) TECHNOLOGICALLY ENHANCED NATURAL RADIATION.

18-2-6-223 HUMAN ENGINEERING - AIDS TO SMOOTH OPERATION
MANZ, G. W.
U.S. NUCLEAR REGULATORY COMMISSION, BETHESDA, MD.
NUCLEAR PLANT CONTROL CONSOLES ARE HUGE, COMPLEX, AND SOMETIMES CONFUSING. SURPRISINGLY, LITTLE ATTENTION TO DATE HAS BEEN PAID TO THE HUMAN ENGINEERING PRACTICES THAT MAXIMIZE RELIABLE HUMAN PERFORMANCE. MAJOR MODIFICATIONS ARE PROHIBITIVE BY COSTS AND PLANT AVAILABILITY, BUT THERE IS MUCH THE OPERATOR CAN DO TO BACKFIT OPERATOR AIDS. THIS ARTICLE PRESENTS NUMEROUS PRACTICAL APPLICATIONS OF INNOVATIVE IDEAS TO AID THE OPERATOR, INCLUDING SOME THAT ARE ALREADY IN USE AT VARIOUS NUCLEAR PLANTS. THESE INNOVATIONS ARE INTENDED TO ASSIST IN LOCATING CONSOLE COMPONENTS, TO SUPPLY ADDITIONAL OPERATING INFORMATION, TO IMPROVE THE USE OF PROCEDURES, AND TO PROTECT VITAL CONTROLS. IF PROPERLY APPLIED, THESE AIDS SHOULD IMPROVE THE SAFETY AND EFFICIENCY OF THE NUCLEAR POWER PLANT.

18-3-1-281 THE REACTOR LICENSING PROCESS - A STATUS REPORT
LONG, J. A.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE NUCLEAR REGULATORY COMMISSION (NRC), IN ITS REVIEW OF APPLICATIONS FOR LICENSES TO CONSTRUCT AND OPERATE NUCLEAR POWER PLANTS, IS REQUIRED TO CONSIDER THOSE MEASURES NECESSARY TO ENSURE THE PROTECTION OF THE HEALTH AND SAFETY OF THE PUBLIC AND THE ENVIRONMENT. THIS ARTICLE DISCUSSES THE NRC STAFF PROCEDURES AND POLICIES FOR CONDUCTING THE DETAILED SAFETY, ENVIRONMENTAL, AND ANTITRUST REVIEWS THAT PROVIDE THE BASIS FOR THESE ASSURANCES. INCLUDED IS A DISCUSSION OF THE IMPROVEMENTS TO THE LICENSING PROCESS CURRENTLY BEING PROPOSED OR IMPLEMENTED TO ENHANCE ITS STABILITY AND PREDICTABILITY FOR THE BENEFIT OF ALL INVOLVED WITH THE REGULATION OF NUCLEAR POWER. THE VIEWS AND OPINIONS EXPRESSED IN THIS ARTICLE ARE THOSE OF THE AUTHOR ALONE AND DO NOT REPRESENT POSITIONS OF THE NRC.

18-3-1-291 TRANSPORT OF RADIOACTIVE MATERIALS IN THE UNITED STATES
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
IN 1975 THE NUCLEAR REGULATORY COMMISSION SPONSORED A SURVEY OF SHIPMENTS OF RADIOACTIVE MATERIALS IN THE UNITED STATES. THE SURVEY WAS CONDUCTED BY BATTELLE PACIFIC NORTHWEST LABORATORIES. OF OVER 15,000 LICENSEES, 2275 WERE SENT QUESTIONNAIRES, AND 59 PERCENT OF THE RECIPIENTS RESPONDED. ON THE BASIS OF THE RESPONSES, IT IS ESTIMATED THAT THE TOTAL NUMBER OF PACKAGES TRANSPORTED IN THE UNITED STATES IS ON THE ORDER OF 2.5 MILLION PACKAGES PER YEAR. ABOUT ONE-THIRD OF THE PACKAGES CONTAIN ONLY SMALL QUANTITIES OF RADIOACTIVE MATERIALS AND ARE EXEMPT FROM PACKAGING AND LABELING REQUIREMENTS OF DEPARTMENT OF TRANSPORTATION REGULATIONS. ON THE BASIS OF THE NUMBER OF PACKAGES SHIPPED ANNUALLY, THE MAJOR RADIONUCLIDES ARE IODINE-131, IODINE-125, TECHNETIUM-99M, MOLYBDENUM-99, AND URANIUM-238, WHEREAS THOSE SHIPPED IN THE GREATEST QUANTITIES (GRAMS OR CURIES) ARE COBALT-60, IRIDIUM-192, AND URANIUM-238. THE MAJORITY OF PACKAGE TYPES SHIPPED ARE EXEMPT TYPES A AND LS (LOW SPECIFIC ACTIVITY), AND THE MOST COMMON MODES OF TRANSPORT WERE TRUCK, AIR, AND RAIL.

18-3-2-298 CRITICAL HEAT FLUX DURING A LOSS OF COOLANT ACCIDENT
GRIFFITH, P. + PEARSON, J. F. + LEPKOWSKI, H. J.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.
A METHOD OF CALCULATING THE MINIMUM TIME TO CRITICAL HEAT FLUX DURING A LOSS OF COOLANT ACCIDENT IS DEVELOPED. THE TIMES CALCULATED IN THIS WAY ARE SHOWN TO BE CONSERVATIVE BUT ARE CLOSE TO THE EXPERIMENTAL VALUES FOR WATER AND QUITE CONSERVATIVE FOR FREON 113. THE MODEL INVOLVES CALCULATING THE TIME REQUIRED TO DRY OUT A CHANNEL IN WHICH THE FLOW IS STAGNATED IN THE MIDDLE IN THE HOT REGION.

18-3-2-306 RESULTS OF THE FIRST THREE NONNUCLEAR TESTS IN THE LOFT FACILITY
MCPHERSON, G. D.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE LOFT FACILITY IS A WELL INSTRUMENTED, SCALED MODEL OF A COMMERCIAL PRESSURIZED-WATER REACTOR. THE FACILITY IS DESIGNED TO STUDY THE BEHAVIOR OF SUCH ENGINEERED SAFETY SYSTEMS AS EMERGENCY CORE-COOLING SYSTEMS DURING REACTOR ACCIDENT CONDITIONS. THIS ARTICLE DESCRIBES THE LOFT FACILITY, THE CURRENT NONNUCLEAR EXPERIMENT SERIES, AND THE FORTHCOMING NUCLEAR EXPERIMENTS. SIGNIFICANT NONNUCLEAR EXPERIMENTAL RESULTS ALSO ARE REPORTED.

18-3-3-317 QUALIFICATION OF SAFETY RELATED SWITCHGEAR FOR NUCLEAR POWER APPLICATIONS
RHOADS, E. W.
ITE IMPERIAL CORPORATION, MONTGOMERYVILLE, PA.
THIS ARTICLE DISCUSSES SOME OF THE PROBLEMS ENCOUNTERED AND A MEANS FOR MEETING THE REQUIREMENTS OF IEEE STANDARD 323-1974 IN DEMONSTRATING QUALIFICATION OF SWITCHGEAR FOR SAFETY RELATED APPLICATIONS IN NUCLEAR POWER GENERATING STATIONS. THE SWITCHGEAR ASSEMBLIES ARE SUBJECTED TO A NUMBER OF TESTS (E.G., SERVICE CONDITIONS, SEISMIC CONDITIONS, LIFE, AND AGING), WHICH

ARE REPORTED AND EVALUATED IN A QUALIFICATION SUMMARY REPORT. THE ARTICLE CONTAINS RECOMMENDATIONS FOR MAINTENANCE, INSPECTION, AND TESTING.

18-3-3-322 EMP AND NUCLEAR PLANT SAFETY
BARNES, P. R.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE ELECTROMAGNETIC PULSE (EMP) FROM A HIGH ALTITUDE NUCLEAR DETONATION CONSISTS OF A TRANSIENT PULSE OF HIGH INTENSITY ELECTROMAGNETIC FIELDS THAT INDUCE CURRENT AND VOLTAGE TRANSIENTS IN ELECTRICAL CONDUCTORS. ALTHOUGH MOST NUCLEAR POWER PLANT CABLES ARE NOT DIRECTLY EXPOSED TO THESE FIELDS, THE ATTENUATED EMP FIELDS THAT PROPAGATE INTO THE PLANT WILL COUPLE SOME EMP ENERGY TO THESE CABLES. THIS ARTICLE ATTEMPTS TO PREDICT THE PROBABLE EFFECTS OF THE EMP TRANSIENTS THAT COULD BE INDUCED IN CRITICAL CIRCUITS OF SAFETY RELATED SYSTEMS. IT IS CONCLUDED THAT THE MOST LIKELY CONSEQUENCE OF EMP FOR NUCLEAR PLANTS IS AN UNSCHEDULED SHUTDOWN. IN GENERAL, EMP COULD BE A NUISANCE TO NUCLEAR POWER PLANTS, BUT IT IS NOT CONSIDERED A SERIOUS THREAT TO PLANT SAFETY.

18-3-5-324 COLD SHOCK TO AQUATIC ORGANISMS - GUIDANCE FOR POWER PLANT SITING, DESIGN, AND OPERATION
COUTANT, C. C.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
PROBLEMS OF COLD SHOCK DAMAGES TO AQUATIC ORGANISMS HAVE ARISEN AT SOME CONDENSER COOLING WATER DISCHARGES OF THERMAL POWER STATIONS WHEN THE WARM WATER RELEASES HAVE SUDDENLY TERMINATED. THE BASIS FOR SUCH DAMAGE LIES IN THE EXPOSURE OF RESIDENT ORGANISMS TO A RAPID DECREASE IN TEMPERATURE AND A SUSTAINED EXPOSURE TO LOW TEMPERATURE THAT INDUCES ABNORMAL BEHAVIORAL OR PHYSIOLOGICAL PERFORMANCE AND OFTEN LEADS TO DEATH. ALTHOUGH SOME SPECTACULAR FISH KILLS FROM COLD SHOCK HAVE OCCURRED, THE PRESENT KNOWLEDGE OF THE HYDRAULIC AND BIOLOGICAL PROCESSES INVOLVED CAN PROVIDE GUIDANCE FOR THE SITING, DESIGN, AND OPERATION OF POWER PLANT COOLING SYSTEMS TO MINIMIZE THE LIKELIHOOD OF SIGNIFICANT COLD SHOCK EFFECTS. PREVENTING COLD-SHOCK DAMAGES IS ONE CONSIDERATION IN MINIMIZING OVERALL ENVIRONMENTAL IMPACTS OF POWER PLANT COOLING AND IN BALANCING PLANT COSTS WITH ENVIRONMENTAL BENEFITS.

18-3-5-343 COMPUTER CODES FOR THE ASSESSMENT OF RADIONUCLIDES RELEASED TO THE ENVIRONMENT
HOFFMAN, F. O. + MILLER, C. W. + SHAEFFER, D. L.
GARTEN, C. T., JR.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE PRESENTS A COMPILATION OF COMPUTER CODES THAT MAY BE USED FOR THE ASSESSMENT OF ACCIDENTAL OR ROUTINE RELEASES OF RADIOACTIVITY TO THE ENVIRONMENT FROM NUCLEAR POWER FACILITIES. THE CAPABILITIES OF 83 COMPUTER CODES IN THE AREAS OF ENVIRONMENTAL TRANSPORT AND RADIATION DOSIMETRY ARE SUMMARIZED IN TABULAR FORM. THIS PRELIMINARY ANALYSIS CLEARLY INDICATES THAT THE INITIAL EFFORTS IN ASSESSMENT METHODOLOGY DEVELOPMENT HAVE CONCENTRATED ON ATMOSPHERIC DISPERSION, EXTERNAL DOSIMETRY, AND INTERNAL DOSIMETRY VIA INHALATION. THE INCORPORATION OF TERRESTRIAL AND AQUATIC FOOD-CHAIN PATHWAYS HAS BEEN A MORE RECENT DEVELOPMENT AND REFLECTS THE NEED FOR SATISFYING THE CURRENT REQUIREMENTS OF ENVIRONMENTAL LEGISLATION AND THE NEEDS OF REGULATORY AGENCIES. THE CHARACTERISTICS OF THE CONCEPTUAL MODELS EMPLOYED BY THESE CODES ARE REVIEWED.

18-3-6-355 STEAM GENERATOR TUBE FAILURES - WORLD EXPERIENCE IN WATER COOLED NUCLEAR REACTORS IN 1975
HARE, M. G.
ATOMIC ENERGY OF CANADA LIMITED, ONTARIO, CANADA
STEAM GENERATOR TUBE FAILURES WERE REPORTED IN 22 OUT OF 62 WATER COOLED NUCLEAR POWER PLANTS SURVEYED IN 1975. THIS WAS LESS THAN THE NUMBER OF PLANTS WITH REPORTED TUBE FAILURES IN 1974, AND THE NUMBER OF TUBES AFFECTED WAS NOTICEABLY LESS. THIS ARTICLE SUMMARIZES THESE FAILURES, MOST OF WHICH WERE DUE TO CORROSION. SECONDARY WATER CHEMISTRY CONTROL, PROCEDURES FOR INSPECTION AND REPAIR, TUBE MATERIALS, AND FAILURE RATES ARE DISCUSSED.

18-3-6-365 OCCUPATIONAL RADIATION EXPOSURES AT LIGHT WATER COOLED POWER REACTORS, 1969-1975
MURPHY, T. D. + DAYEM, N. J. + BLAND, J. S.
PASCIAK, W. J.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THIS ARTICLE IS A COMPILATION OF OCCUPATIONAL RADIATION EXPOSURES AT COMMERCIAL LIGHT WATER COOLED REACTORS (LWRS) FROM 1969 TO 1975 AND UPDATES PREVIOUS INFORMATION THAT COVERED EXPOSURES THROUGH 1974. THE INFORMATION WAS DERIVED FROM REPORTS SUBMITTED TO THE NUCLEAR REGULATORY COMMISSION IN ACCORDANCE WITH REQUIREMENTS OF INDIVIDUAL PLANT TECHNICAL SPECIFICATIONS AND THE CODE OF FEDERAL REGULATIONS. THE COLLECTIVE DOSE TO PERSONNEL (MAN-REMS PER REACTOR PER YEAR) AT LWRS WAS GREATER IN 1975 THAN IN 1974. ALTHOUGH THE AVERAGE EXPOSURE PER INDIVIDUAL REMAINED AT 0.8 REM/YEAR, THE AVERAGE NUMBER OF PERSONNEL RECEIVING MEASUREABLE EXPOSURES PER REACTOR INCREASED IN 1975.

18-3-6-370 RADIOACTIVE EFFLUENTS FROM NUCLEAR POWER STATIONS IN EUROPE, 1970-1974
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
(EDITOR'S NOTE - THE PRODUCTION OF ELECTRICITY BY THE USE OF NUCLEAR POWER IS A WORLDWIDE PHENOMENON, AS IS THE CONCOMITANT CONCERN REGARDING RADIOACTIVE EFFLUENTS.) THIS ARTICLE WAS ADAPTED BY THE NUCLEAR SAFETY STAFF FROM A RECENT REPORT BY THE COMMISSION OF EUROPEAN COMMUNITIES THAT SUMMARIZES THE DISCHARGE DATA FOR SOME 30 POWER REACTORS (LESS THAN 50 MW(E)) OPERATING WITHIN THE EUROPEAN COMMUNITY. ON THE BASIS OF THESE DISCHARGES, MAXIMUM EXPOSURE IN THE VICINITY OF POWER STATIONS IS ASSESSED AND COMPARED WITH THE DOSE LIMITS FIXED BY RADIOLOGICAL PROTECTION STANDARDS AND WITH THE NATURAL RADIATION LEVEL. ALSO, THE RADIOACTIVE WASTE DISCHARGE PER UNIT ELECTRICAL ENERGY PRODUCED IS GIVEN FOR EACH POWER STATION. IN GENERAL, THE EUROPEAN EXPERIENCE IS SIMILAR TO THAT OF THE UNITED STATES, WHERE, IN ACCORDANCE WITH NRC 'AS LOW AS REASONABLY ACHIEVABLE' REGULATIONS, INDUSTRIAL OFF-SITE EXPOSURES MUST BE KEPT BELOW 5 MREMS/YEAR.

18-4-1-427 THE HOMEMADE NUCLEAR BOMB SYNDROME
MEYER, W. J. + LOYALKA, S. K. + NELSON, W. E.
WILLIAMS, R. W.
UNIVERSITY OF MISSOURI, COLUMBIA, MO.
WITH THE PUBLICATION OF NUCLEAR THEFT - RISKS AND SAFEGUARDS BY WILLRICH AND TAYLOR, SIGNIFICANT ATTENTION HAS BEEN FOCUSED BY THE MEDIA AND THE PUBLIC ON THE POSSIBILITY OF FISSILE MATERIALS BEING STOLEN BY A TERRORIST ORGANIZATION AND DIVERTED TO THE ACTUAL BUILDING, OR THE THREAT OF BUILDING, OF A NUCLEAR EXPLOSIVE DEVICE. THE IMPLICATION HAS BEEN CREATED THAT ONE OR SEVERAL RELATIVELY INEXPERIENCED INDIVIDUALS COULD OBTAIN THE MATERIALS NECESSARY AND FABRICATE A LOW-YIELD NUCLEAR EXPLOSIVE. THIS ARTICLE EXAMINES THESE CONTENTIONS IN SOME DETAIL. THE SAFEGUARDS AND USE-DENIAL METHODS PRESENTLY USED IN THE NUCLEAR FUEL CYCLE ARE CONSIDERED, AND THE DIFFICULTIES THEY PRESENT IN OBTAINING SIGNIFICANT AMOUNTS OF STRATEGIC NUCLEAR MATERIALS ARE EXAMINED. THE CHARACTERISTICS OF REACTOR GRADE PLUTONIUM ARE DISCUSSED, AND THE DIFFICULTIES ASSOCIATED WITH THE ASSEMBLY OF AN EFFICIENT NUCLEAR EXPLOSIVE DEVICE ARE OUTLINED.

18-4-1-438 THE RUSSIAN APPROACH TO NUCLEAR REACTOR SAFETY
LEWIS, J.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
SOVIET REACTOR AND POWER STATION DESIGN INITIALLY PROCEEDED FROM A SAFETY PHILOSOPHY THAT DID NOT ACKNOWLEDGE A LOSS OF COOLANT ACCIDENT CAUSED BY A DOUBLE ENDED PIPE BREAK NOR A MASSIVE CORE MELTDOWN AS CREDIBLE EVENTUALITIES TO BE CONSIDERED IN THE DESIGN OF SYSTEMS AND DETAILS. GENERALLY, ENGINEERED SAFEGUARDS AND CONSERVATISM IN DESIGN HAVE BEEN REGARDED AS ADEQUATE INSURANCE AGAINST ACCIDENTS THAT COULD ESCALATE TO A POINT WHERE THERE IS SIGNIFICANT RADIATION DAMAGE TO EITHER PLANT PERSONNEL OR THE PUBLIC. RECENTLY, THERE HAS BEEN SOME CHANGE IN THE ATTITUDE OF SCIENTISTS TOWARD SECONDARY CONTAINMENT IN PRESSURIZED WATER REACTOR PLANTS. IN PRESSURE TUBE BOILING WATER REACTORS AND LIQUID METAL COOLED FAST BREEDER REACTORS. SOVIET EXPERIENCE ON SEVERAL DEMONSTRATION AND 'SEMICOMMERCIAL' UNITS HAS BEEN INTERPRETED TO MEAN THAT CORE DAMAGE PROPAGATION AND ACCIDENTS INVOLVING LARGE ENERGY RELEASES ARE NOT CREDIBLE. IT APPEARS, HOWEVER, THAT THERE IS NOT COMPLETE UNANIMITY ON ALL SAFETY QUESTIONS, AND GREATER DISPERSION OF AUTHORITY AND MORE FORMAL SAFETY REVIEWS SEEM TO BE IN THE MAKING.

18-4-2-451 1976 INTERNATIONAL MEETING ON FAST REACTOR SAFETY AND RELATED PHYSICS
FONTANA, M. H.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE REVIEWS SOME OF THE SIGNIFICANT SAFETY TOPICS THAT WERE DISCUSSED DURING THE INTERNATIONAL MEETING ON FAST REACTOR SAFETY AND RELATED PHYSICS HELD IN CHICAGO ON OCT. 5-8, 1976, UNDER THE AUSPICES OF THE AMERICAN NUCLEAR SOCIETY AND THE NEWLY FORMED EUROPEAN NUCLEAR SOCIETY. TWENTY-NINE SESSIONS WERE HELD, INCLUDING TWO PLENARY SESSIONS. MORE THAN 226 PAPERS WERE PRESENTED. BECAUSE OF THE IMPOSSIBILITY OF REPORTING ALL THE SESSIONS, THE REVIEWER HAS ATTEMPTED TO CONVEY A CONSENSUS OF THE STATE OF THE ART OF FAST REACTOR SAFETY AS REPORTED AT THIS MEETING.

18-4-3-469 IN-SERVICE INSPECTION TECHNIQUES FOR LIQUID METAL COOLED FAST BREEDER REACTORS
MCCLUNG, R. W. + SPANNER, J. C. + HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN. AND WESTINGHOUSE HANFORD COMPANY, RICHLAND, WASH.
ALTHOUGH FIRM REQUIREMENTS HAVE NOT YET BEEN ESTABLISHED IN THE UNITED STATES FOR IN-SERVICE INSPECTION OF LIQUID METAL COOLED FAST BREEDER REACTORS, SOME INITIAL DEVELOPMENT WORK ON POTENTIALLY APPLICABLE NONDESTRUCTIVE TESTING METHODS HAS BEEN CONDUCTED. THIS ARTICLE DESCRIBES PRELIMINARY INVESTIGATIONS OF SEVERAL ADVANCED NONDESTRUCTIVE TESTING CONCEPTS FOR LIQUID SODIUM SYSTEMS. THE METHODS HIGHLIGHTED FOR POTENTIAL APPLICATION ARE ULTRASONICS, EDDY CURRENTS, ELECTROTHERMAL TESTING, UNDER SODIUM VIEWING, AND RADIOGRAPHY.

18-4-4-491 NUCLEAR SAFETY EXPERIMENTS IN THE MARVIKEN POWER STATION
SLAUGHTERBECK, D. C. + ERICSON, L.
MARVIKEN, SWEDEN
THIS ARTICLE REVIEWS THREE MULTINATIONAL PROJECTS CONCERNING FULL SCALE NUCLEAR SAFETY EXPERIMENTS AT THE MARVIKEN POWER STATION IN SWEDEN. EXPERIMENTS IN THE FIRST PROJECT, CARRIED OUT IN 1972 AND 1973, WERE RELATED TO THE RESPONSE OF THE PRESSURE SUPPRESSION CONTAINMENT TO SIMULATED RUPTURES IN PIPE SYSTEMS CONNECTED TO THE PRESSURE VESSEL. EXPERIMENTS IN THE SECOND PROJECT, CURRENTLY UNDER WAY, ARE RELATED TO PRESSURE OSCILLATIONS IN THE CONTAINMENT SYSTEM FOLLOWING SIMULATED RUPTURES IN THE PIPE SYSTEM. THE THIRD PROJECT CONCERNS A PROPOSED PROGRAM FOR THE EXPERIMENTAL INVESTIGATION OF CRITICAL MASS FLOW THROUGH SIMULATED RUPTURES IN A FULL SCALE PIPING SYSTEM.

18-4-5-492 CONTROLLING OCCUPATIONAL RADIATION EXPOSURE AT OPERATING NUCLEAR POWER STATIONS
DICKSON, H. W. + OAKES, T. W. + SHANK, K. E.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE HISTORICAL DEVELOPMENT OF THE PHILOSOPHY OF KEEPING THE RADIATION EXPOSURE OF WORKERS AT LIGHT WATER REACTORS AS LOW AS REASONABLY ACHIEVABLE (ALARA) IS PRESENTED. A REVIEW IS MADE OF SOME OF THE ALARA ACTIVITIES OF THE NUCLEAR REGULATORY COMMISSION, THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, AND VARIOUS NUCLEAR INSTALLATIONS. DATA COMPILED BY THE NRC SHOW THAT ROUTINE AND SPECIAL MAINTENANCE AT LIGHT WATER REACTORS ACCOUNTS FOR 72 PERCENT OF ALL OCCUPATIONAL EXPOSURE AT THESE SITES. THE ROLE THAT OAK RIDGE NATIONAL LABORATORY HAS TAKEN IN ALARA RESEARCH IS PRESENTED, WITH EMPHASIS PLACED ON A STUDY OF VALVE MALFUNCTIONS AT LIGHT WATER REACTORS. THE VALVE STUDY INDICATES A TREND TOWARD DECREASING VALVE RELIABILITY OVER THE PAST FEW YEARS. FINALLY A COST BENEFIT ANALYSIS OF RADIATION DOSE REDUCTION IS DISCUSSED. THE RATIONALE FOR ASSIGNING A COST PER MAN REM BASED ON THE RADIATION EXPOSURE LEVEL THAT IS ENCOUNTERED IS PRESENTED.

18-4-5-502 INTERNATIONAL WASTE MANAGEMENT SYMPOSIUM
SHOUP, R. L.
UNION CARBIDE CORPORATION, NUCLEAR DIVISION, OAK RIDGE, TENN.
AN INTERNATIONAL SYMPOSIUM ON THE MANAGEMENT OF WASTES FROM THE LWR FUEL CYCLE WAS HELD IN DENVER, COLO., ON JULY 11-16, 1976. THE SYMPOSIUM COVERED A BROAD RANGE OF TOPICS FROM POLICY ISSUES TO TECHNOLOGY. PRESENTATIONS WERE MADE BY NATIONAL AND INTERNATIONAL SPEAKERS INVOLVED IN ALL ASPECTS OF WASTE MANAGEMENT - GOVERNMENT AND AGENCY OFFICIALS, LABORATORY MANAGERS, DIRECTORS, AND RESEARCHERS, AND INDUSTRIAL REPRESENTATIVES. MANY SPEAKERS ADVOCATED PRAGMATIC ACTION ON PROGRAMS FOR THE MANAGEMENT OF COMMERCIAL NUCLEAR WASTES TO COMPLETE THE LIGHT WATER REACTOR (LWR) FUEL CYCLE. THE INDUSTRIALIZED NATIONS' DEMAND FOR INCREASING SUPPLIES OF ENERGY AND THEIR INCREASING DEPENDENCE ON NUCLEAR ENERGY TO FULFILL THIS DEMAND WILL NECESSITATE THE DEVELOPMENT OF AN ACCEPTABLE SOLUTION TO THE DISPOSAL OF NUCLEAR WASTES WITHIN THE NEXT DECADE FOR SOME INDUSTRIAL NATIONS. WASTE DISPOSAL TECHNOLOGY SHOULD BE IMPLEMENTED ON A COMMERCIAL SCALE, BUT THE COMMERCIALIZATION MUST BE ACCOMPANIED BY THE DECISION TO USE THE TECHNOLOGY. AN IMPORTANT ISSUE IN THE USE OF NUCLEAR ENERGY IS THE QUESTION OF SHARING THE TECHNOLOGY WITH THE LESS INDUSTRIALIZED NATIONS AND WITH NATIONS THAT MAY NOT HAVE SUITABLE MEANS TO DISPOSE OF NUCLEAR WASTES. THE ESTABLISHMENT OF INTERNATIONAL AND MULTINATIONAL COOPERATION WILL BE AN IMPORTANT KEY IN REALIZING THIS OBJECTIVE. PRESSING ISSUES THAT INTERNATIONAL ORGANIZATIONS OR TASK GROUPS WILL HAVE TO ADDRESS ARE OCEAN DISPOSAL, PLUTONIUM RECYCLING AND SAFEGUARDS, AND DISPOSAL CRITERIA. THE IMPORTANCE OF ACHIEVING A VIABLE WASTE MANAGEMENT PROGRAM IS MADE EVIDENT BY THE INCREASED FUNDING AND ATTENTION THAT THE BACK END OF THE FUEL CYCLE IS NOW RECEIVING.

18-4-6-513 REACTOR VESSEL PRESSURE TRANSIENTS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
(EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED BY THE NUCLEAR SAFETY SECTION EDITOR FROM A NUCLEAR REGULATORY COMMISSION (NRC) DOCUMENT ENTITLED 'TECHNICAL REPORT ON REACTOR PRESSURE VESSEL TRANSIENTS,' WHICH WAS INCLUDED AS AN ATTACHMENT TO NUREG-0138, 'STAFF DISCUSSION OF FIFTEEN TECHNICAL ISSUES LISTED IN ATTACHMENT TO NOVEMBER 3, 1976, MEMORANDUM FROM DIRECTOR OF NRR TO NRR STAFF.' SINCE SPACE LIMITATIONS DO NOT PERMIT US TO INCLUDE THE TECHNICAL REPORT IN ITS ENTIRETY, THE EDITORS HAVE PREPARED THE FOLLOWING CONDENSED VERSION LARGELY FROM EXCERPTS FROM THE ORIGINAL. THE ORIGINAL REPORT, DATED NOV. 1, 1976, WAS PREPARED BY A TASK GROUP WORKING UNDER THE AUSPICES OF THE NRC OFFICE OF NUCLEAR REACTOR REGULATION AND CHAIRED BY D. G. EISENHUT. THIS REPORT SUMMARIZES THE RELEVANT TECHNICAL CONSIDERATIONS, DISCUSSES THE SAFETY CONCERNS AND EXISTING MARGINS AT OPERATING REACTORS, AND DESCRIBES THE REGULATORY ACTIONS BEING TAKEN TO REDUCE THE LIKLIHOOD OF FUTURE PRESSURE TRANSIENT EVENTS AT OPERATING REACTORS.)

18-4-6-523 OCCUPATIONAL RADIATION EXPOSURES AT LICENSED FACILITIES, 1975
BROOKS, D. G.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
PERSONNEL OCCUPATIONAL RADIATION EXPOSURES FOR CALENDAR YEAR 1975 WERE OBTAINED FROM ANNUAL AND TERMINATION REPORTS SUBMITTED BY VARIOUS TYPES OF NUCLEAR REGULATORY COMMISSION LICENSEES, INCLUDING NUCLEAR POWER PLANTS AND INDUSTRIAL RADIOGRAPHERS, AS WELL AS FUEL AND BY-PRODUCT PROCESSORS, FABRICATORS, AND REPROCESSORS. ANNUAL REPORTS RECEIVED FROM 387 LICENSEES INDICATED THAT SOME 78,713 INDIVIDUALS, WHO INCURRED AN AVERAGE EXPOSURE OF 0.30 REM, WERE MONITORED FOR EXPOSURE TO RADIATION DURING 1975 AND THAT 21,601 INDIVIDUALS TERMINATED THEIR EMPLOYMENT OR WORK ASSIGNMENT IN 1975. THE NUMBER OF PERSONNEL OVEREXPOSURES REPORTED IN 1975 DECREASED FROM PREVIOUS YEARS.

18-5-1-581 TRENDS IN THE LICENSING OF NUCLEAR POWER PLANTS
KNUTH, D. F. + MCEWEN, J. E., JR.
KMC, INC., WASHINGTON, D.C.
THIS ARTICLE PRESENTS A BRIEF SUMMARY OF THE U.S. NUCLEAR LICENSING EXPERIENCE AND DISCUSSES THE EFFECT ON COSTS AND TIME TO PLACE A UNIT IN SERVICE. RECENT NUCLEAR REGULATORY COMMISSION POLICY INNOVATIONS, SUCH AS STANDARD REVIEW PLANS, STANDARD FORMAT, STANDARDIZATION, AND GENERIC HEARINGS, ARE DISCUSSED ALONG WITH OBSERVATIONS OF THE IMPACT ON THE LICENSING REVIEW. TECHNICAL AND POLICY UNCERTAINTIES THAT ARE CURRENTLY FACING LICENSEES ARE ALSO DISCUSSED, AS ARE THE POTENTIAL IMPACTS OF TECHNICAL AND LEGAL INTERFACES REQUIRED BY THE INCREASING NUMBER OF GENERIC HEARINGS, STATE HEARINGS, AND FEDERAL COURT REVIEWS.

18-5-1-589 NRC INTERNATIONAL AGREEMENTS ON REACTOR SAFETY RESEARCH
BENNETT, G. L. + SPANO, A. M. + SZAWLEWICZ, S. A.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE NUCLEAR REGULATORY COMMISSION AND ITS PREDECESSOR, THE ATOMIC ENERGY COMMISSION, HAVE ENTERED INTO A NUMBER OF REACTOR SAFETY RESEARCH AGREEMENTS WITH OTHER COUNTRIES. THESE AGREEMENTS INVOLVE VARIOUS FORMS OF COOPERATION INCLUDING BILATERAL INFORMATION EXCHANGE AND JOINT RESEARCH PARTICIPATION IN SPECIFIC PROJECTS ON A BILATERAL OR MULTILATERAL LEVEL. UNDER THE TERMS OF THESE AGREEMENTS, REPORTS, COMPUTER CODES, AND DATA MAY BE EXCHANGED AND PERSONNEL VISITS AND ASSIGNMENTS PERMITTED. THESE AGREEMENTS HAVE PROVED TO BE BENEFICIAL IN PROVIDING FOR A COST EFFECTIVE EXTENSION OF THE BASE OF REACTOR SAFETY INFORMATION AVAILABLE TO THE PARTIES CONCERNED. SUCH AGREEMENTS HELP TO ENHANCE REACTOR SAFETY WORLDWIDE.

18-5-2-596 A REVIEW OF SHORT TERM FISSION PRODUCT DECAY POWER
BJERKE, M. A. + HOLM, J. S. + SHAY, M. R.
SPINRAD, B. I.
OREGON STATE UNIVERSITY, CORVALLIS, OREG.
EXPERIMENTS ON SHORT TERM FISSION PRODUCT DECAY POWER, WHICH MAY BE IMPORTANT FOR LOSS OF COOLANT ACCIDENT ANALYSIS, ARE REVIEWED. THE MOST RECENT EXPERIMENTS GIVE SUFFICIENT DATA TO FORM THE BASIS OF REASONABLE STANDARDS, PARTICULARLY WHEN THEY ARE SUPPLEMENTED WITH RESULTS FROM SUMMATION PREDICTIONS. THE PREPARATION OF IMPROVED STANDARDS FOR SCIENTIFIC AND REGULATORY PURPOSES IS IN AN ADVANCED STAGE. PRELIMINARY ESTIMATES INDICATE THAT THE EXISTING STANDARD PROPOSED BY THE AMERICAN NUCLEAR SOCIETY HAS AN EXTREMELY CONSERVATIVE UNCERTAINTY BAND ASSOCIATED WITH IT. NEW DATA PROVIDE FIRM JUSTIFICATION FOR REDUCING THE UNCERTAINTY ASSOCIATED WITH THE EXISTING STANDARD.

18-5-3-617 INSTRUMENTATION PROGRAMS FOR NUCLEAR POWER PLANT SITES
ALLEN, J. M. + KARNER, D. D.
ARIZONA NUCLEAR POWER PROJECT, PHOENIX, ARIZ.
TYPICAL INSTRUMENTATION PROGRAMS TO DETERMINE THE SUITABILITY OF A PROPOSED NUCLEAR POWER PLANT SITE ARE DESCRIBED. AN OVERVIEW OF REGULATORY REQUIREMENTS IS PRESENTED, ALONG WITH A BRIEF DISCUSSION OF TYPICAL METEOROLOGICAL, SEISMOLOGICAL, GEOLOGICAL, RADIOLOGICAL, AND SEWAGE EFFLUENT MONITORING SYSTEMS. THE DISCUSSION DEFINES THE VARIOUS PARAMETERS THAT MUST BE MEASURED AND DESCRIBES THE TYPICAL SENSORS, TRANSDUCERS, AND INSTRUMENTATION USED. PROBLEMS PRESENTED BY A REMOTE DESERT SITE, SUCH AS ONE LOCATED IN THE ARID SOUTHWESTERN UNITED STATES, ARE ALSO DISCUSSED.

18-5-3-624 COMMON-MODE FAILURES IN REACTOR SAFETY SYSTEMS
JOLLY, M. E. + WREATHALL, J.
U.K. CENTRAL ELECTRICITY GENERATING BOARD
THIS ARTICLE DESCRIBES THE PRINCIPLES ADOPTED BY THE U.K. CENTRAL ELECTRICITY GENERATING BOARD IN TACKLING THE HAZARDS OF COMMON-MODE FAILURES IN REACTOR SAFETY EQUIPMENT AND INDICATES THE WAYS IN WHICH THE PRINCIPLES ARE IMPLEMENTED IN PRACTICE. WHERE APPROPRIATE, REFERENCE IS ALSO MADE TO APPLICATIONS IN POSTTRIP COOLING AREAS. RECOGNITION IS GIVEN TO THE FACT THAT DIVERSITY IS NOT AN ABSOLUTE MEASURE, BUT ONE WHICH HAS VARYING DEGREES OF DEPTH. THE DISCUSSION IS EXTENDED TO SHOW THAT THE USE OF EXAMINATION IN DEPTH MUST INCLUDE NOT ONLY HARDWARE BUT ALSO CALCULATIONAL METHODS AND OPERATOR ASPECTS. IT IS CONCLUDED THAT THERE IS NO OBJECTIVE WAY OF

ESTABLISHING THE PROBABILITY OF COMMON-MODE FAILURE FOR HIGH INTEGRITY EQUIPMENT AND THAT THERE IS NO SUBSTITUTE FOR THE USE OF ENGINEERING EXPERIENCE IN DEPTH.

18-5-4-633 CURRENT CHALLENGES IN AIR CLEANING AT NUCLEAR FACILITIES
MOELLER, D. W.
HARVARD UNIVERSITY, BOSTON, MASS.
THE SAFE OPERATION OF NUCLEAR FACILITIES IS HEAVILY DEPENDENT UPON THE ADEQUATE PERFORMANCE OF AIR CLEANING SYSTEMS. ALTHOUGH MANY PROBLEMS HAVE BEEN SOLVED, NEW QUESTIONS AND NEW CHALLENGES CONTINUE TO ARISE. THESE ARE WELL ILLUSTRATED BY WEAKNESSES IN AIR CLEANING AND VENTILATING SYSTEMS REVEALED IN THE BROWNS FERRY FIRE AND BY THE NEED TO DEVELOP ADDITIONAL DATA ON THE RELIABILITY OF SUCH SYSTEMS, PARTICULARLY UNDER EMERGENCY CONDITIONS, AS ENUMERATED IN THE REACTOR SAFETY STUDY. ASSESSMENTS OF THE DEGREE TO WHICH ENGINEERED SAFETY FEATURES CAN COMPENSATE FOR DEFICIENCIES IN NUCLEAR POWER PLANT SITES CONTINUE TO CONCERN THOSE INVOLVED IN RISK / BENEFIT EVALUATIONS.

18-5-5-647 TRENDS IN PUBLIC HEALTH IN THE POPULATION NEAR NUCLEAR FACILITIES - A CRITICAL ASSESSMENT
PATRICK, C. H.
U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, WASHINGTON, D.C.
TEN STUDIES THAT HAVE LOOKED SPECIFICALLY AT CHANGES IN PUBLIC HEALTH IN AREAS NEAR NUCLEAR FACILITIES ARE CRITICALLY REVIEWED. ALL BUT ONE OF THESE STUDIES HAVE BEEN UNABLE TO SHOW ADVERSE HEALTH EFFECTS IN THE LOCAL POPULATION THAT MIGHT BE RELATED TO RADIATION EXPOSURE. THE ONE STUDY THAT PURPORTS TO FIND AN ADVERSE EFFECT HAS SEVERE METHODOLOGICAL LIMITATIONS, WHICH PRECLUDE ANY MEANINGFUL INTERPRETATION OF THE DATA. ALSO PRESENTED IS AN ANALYSIS OF THE INDICATORS OF PUBLIC HEALTH IN THE AREA OF OAK RIDGE, TENN., WHICH SHOWS CANCER MORTALITY RATES THAT ARE NOT SIGNIFICANTLY HIGHER THAN WOULD BE EXPECTED IN THE GENERAL U.S. POPULATION, ALTHOUGH MUCH MORE RESEARCH IS NEEDED BEFORE ALL THE EFFECTS OF VERY LOW LEVELS OF RADIATION FROM NUCLEAR REACTORS WILL BE KNOWN. THE EXISTING STUDIES SUGGEST THAT NUCLEAR POWER PLANTS WILL NOT HAVE A SIGNIFICANT IMPACT ON PUBLIC HEALTH AS A RESULT OF NORMAL OPERATIONS.

18-5-6-604 NUCLEAR POWER PLANT PERFORMANCE ANALYSIS
KUFFER, K.
NORDOSTSCHWEIZERISCHE KRAFTWERK, BADEN, SWITZERLAND
EDITOR'S NOTE - IN NOVEMBER 1976 THE INTERNATIONAL CONFERENCE ON WORLD NUCLEAR POWER WAS HELD IN WASHINGTON, D.C., AND WAS JOINTLY SPONSORED BY THE AMERICAN NUCLEAR SOCIETY AND THE EUROPEAN NUCLEAR SOCIETY. K. KUFFER, WHO WAS COCHAIRMAN OF ONE OF THE SESSIONS, OPENED THAT SESSION WITH THE REMARKS THAT COMPRISE THE TEXT OF THIS ARTICLE. DR. KUFFER IS ASSOCIATED WITH NORDOSTSCHWEIZERISCHE KRAFTWERK OF BADEN, SWITZERLAND, AND HAS BEEN DEEPLY INVOLVED WITH THE OPERATION OF THE BEZNAU NUCLEAR POWER STATION. HIS REMARKS SUMMARIZE POWER PLANT PERFORMANCE IN EUROPE, IN THE UNITED STATES, AND ELSEWHERE AND SHOULD BE OF INTEREST TO ALL PERSONS CONCERNED WITH SUCH ACTIVITIES.

18-5-6-666 OPERATING EXPERIENCE WITH 13 LIGHT WATER REACTORS IN EUROPE
LUTZ, H. R. + KUFFER, K. + SCHENK, K.
KERNKRAFTWERK MUEHLEBERG DER BERNISCHE KRAFTWERK, MUEHLEBERG, SWITZERLAND / KERNKRAFTWERK BEZNAU DER NORDOSTSCHWEIZERISCHE KRAFTWERK, DOETTINGEN, SWITZERLAND / KERNKRAFTWERK OBRIGHEIM GMBH, OBRIGHEIM, NECKAR, FEDERAL REPUBLIC OF GERMANY
THE OPERATING EXPERIENCE OF 13 EUROPEAN LIGHT WATER REACTOR (LWR) POWER STATIONS THAT BEGAN OPERATION PRIOR TO JANUARY 1973 IS PRESENTED. GIVEN ARE KEY PARAMETERS, SUCH AS AVERAGE LOAD FACTOR, LOAD DIAGRAMS, NONAVAILABILITY ANALYSES, STATISTICS ON LEAKING FUEL ELEMENTS, RADIOACTIVITY DISCHARGE VALUES, SIZE OF POWER STATION STAFFS, MAN REM EXPOSURES, ADDITIONAL INVESTMENTS, ETC. SOME SPECIAL EVENTS ARE DESCRIBED IN DETAIL. THEORIES FOR THE DISPARITIES IN CAPACITY FACTORS BETWEEN EUROPEAN AND AMERICAN LWR POWER STATIONS AND BETWEEN PRESSURIZED WATER REACTOR AND BOILING WATER REACTOR POWER STATIONS ARE ALSO PRESENTED.

18-6-1-727 GERMAN LIGHT WATER REACTOR SAFETY RESEARCH PROGRAM
SEIPEL, H. G. + LUNNERZHEIM, D. + RITTIG, D.
FEDERAL MINISTRY OF RESEARCH AND TECHNOLOGY, FEDERAL REPUBLIC OF GERMANY
THE LIGHT WATER REACTOR SAFETY RESEARCH PROGRAM, WHICH IS PART OF THE ENERGY PROGRAM OF THE FEDERAL REPUBLIC OF GERMANY, IS PRESENTED IN THIS ARTICLE. THE PROGRAM, FOR WHICH THE FEDERAL MINISTER OF RESEARCH AND TECHNOLOGY OF THE FEDERAL REPUBLIC OF GERMANY IS RESPONSIBLE, IS SUBDIVIDED INTO THE FOLLOWING FOUR MAIN PROBLEM AREAS, WHICH IN TURN ARE SUBDIVIDED INTO PROJECTS (1) IMPROVEMENT OF THE OPERATIONAL SAFETY AND RELIABILITY OF SYSTEMS AND COMPONENTS (PROJECTS - QUALITY ASSURANCE, COMPONENT SAFETY) (2) ANALYSIS OF THE CONSEQUENCES OF ACCIDENTS (PROJECTS - EMERGENCY CORE COOLING, CONTAINMENT, EXTERNAL IMPACTS, PRESSURE VESSEL FAILURE, CORE MELTDOWN) (3) ANALYSIS OF RADIATION EXPOSURE DURING OPERATION, ACCIDENT, AND DECOMMISSIONING (PROJECT - FISSION PRODUCT TRANSPORT AND RADIATION EXPOSURE) AND (4) ANALYSIS OF THE RISK CREATED BY

THE OPERATION OF NUCLEAR POWER PLANTS (PROJECT - RISK AND RELIABILITY). VARIOUS PROBLEMS, WHICH ARE INCLUDED IN THE ABOVE MENTIONED PROJECTS, ARE CONCURRENTLY STUDIED WITHIN THE HEISS-DAMPF REAKTOR EXPERIMENTS. INVESTIGATIONS ON THE SAFETY OF PRESSURIZED REACTOR COMPONENTS IN CONNECTION WITH RESEARCH AND DEVELOPMENT ACTIVITIES ON NONDESTRUCTIVE TESTING HAVE SHOWN THAT THE HIGH SAFETY STANDARDS THAT MUST BE SET FOR NUCLEAR INSTALLATIONS CAN BE MET BY A COMPREHENSIVE QUALITY ASSURANCE SYSTEM, WHEREBY THE MATERIAL AND PROCEDURAL TESTS, AS WELL AS THE NONDESTRUCTIVE TESTS BEFORE AND DURING THE OPERATION, ARE CAREFULLY COORDINATED WITH EACH OTHER. FURTHER INVESTIGATIONS ARE CONCENTRATED ON THE SAFETY MARGINS DURING LONGTIME OPERATION.

18-6-1-756 NUCLEAR SAFETY AT SALZBURG
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE IS A REVIEW OF SELECTED MATERIAL FROM THE IAEA INTERNATIONAL CONFERENCE ON NUCLEAR POWER AND ITS FUEL CYCLE HELD IN SALZBURG, AUSTRIA, MAY 2-13, 1977 (IAEA-CN-36). THE SESSIONS CONSIDERED DEAL WITH NUCLEAR REACTOR SAFETY AND PUBLIC OPINION. ALTHOUGH THE SUBSEQUENT DISCUSSION INCLUDES COMMENTS ON THE ENTIRE MEETING. IN GENERAL, THE SAFETY PAPERS ARE OF VALUE BECAUSE OF THEIR COMPREHENSIVE REVIEW OF THE SUBJECT MATTER RATHER THAN TO ANY SIGNIFICANT NEW DEVELOPMENTS. THE SESSIONS ON PUBLIC OPINION NOT ONLY INDICATED THE UNIVERSALITY OF THIS ELEMENT BUT ALSO REVEALED DIFFERING DEGREES OF CONCERN AND LEVELS OF RESPONSE. DESPITE THE MANY TECHNICAL PRESENTATIONS OF MERIT, THE CONFERENCE WAS DOMINATED BY THE PREVIOUSLY ANNOUNCED U.S. POLICY CONCERNING THE RECYCLING OF NUCLEAR FUEL AND THE DEPLOYMENT OF THE FAST BREEDER REACTOR. THE GENERAL AGREEMENT WITH REGARD TO THE NEED TO PREVENT THE SPREAD OF NUCLEAR WEAPONS DID NOT ENCOMPASS THE NEW U.S. POSITION.

18-6-2-761 AN ASSESSMENT OF HTGR ACCIDENT CONSEQUENCES
BARSELL, A. W. + JOKSIMOVIC, V. + SILADY, F. A.
GENERAL ATOMIC COMPANY, SAN DIEGO, CALIF.
ASSESSMENTS WERE MADE OF THE CONSEQUENCES OF THE HIGHER RISK ACCIDENT CONDITIONS POSTULATED TO OCCUR IN A REFERENCE 1975 GENERAL ATOMIC 3000-MW(T) HIGH TEMPERATURE GAS COOLED REACTOR. THIS PROBABILISTIC RISK ASSESSMENT STUDY, KNOWN AS ACCIDENT INITIATION AND PROGRESSION ANALYSIS, IS FUNDED BY THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION. THE MOST REPRESENTATIVE ACCIDENT CONDITIONS ARE (1) CORE HEATUP CAUSED BY A LOSS OF OFF-SITE POWER OR BY A LARGE EARTHQUAKE, LEADING TO A LOSS OF FORCED CIRCULATION, (2) REHEATER TUBE FAILURE, (3) DEPRESSURIZATION OF THE PRIMARY COOLANT, AND (4) STEAM GENERATOR MAIN BUNDLE TUBE FAILURE. THE RADIOLOGICAL CONSEQUENCES, WHICH ARE BASED ON REPRESENTATIVE U.S. POPULATION DENSITIES, WERE ASSESSED IN REMS AS A FUNCTION OF DISTANCE FROM THE PLANT AND MAN-REM EXPOSURES TO THE SURROUNDING ENVIRONMENT. THE RESULTS INDICATE THAT THE HIGH TEMPERATURE GAS COOLED REACTOR HAS EXCELLENT SAFETY CHARACTERISTICS, WHICH ARE INHERENT IN THE CONCEPT AND ARE PRIMARILY ASSOCIATED WITH THE CHOICE OF COOLANT AND CORE DESIGN. OVER A WIDE RANGE OF ACCIDENT FREQUENCIES (FROM ONE ACCIDENT PER REACTOR YEAR TO ONE ACCIDENT IN 10 MILLION REACTOR-YEARS), NO ACCIDENTS CONSIDERED IN THE STUDY ARE PREDICTED TO CAUSE EARLY OR DELAYED FATALITIES OR ILLNESSES.

18-6-3-774 HUMAN FACTORS IN THE NUCLEAR CONTROL ROOM
SEMINARA, J. L. + PACK, R. W. + GONZALEZ, W. R.
PARSONS, S. O.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF. / LOCKHEED MISSILES AND SPACE COMPANY, INC., SUNNYVALE, CALIF.
HUMAN FACTORS ENGINEERING IS AN INTERDISCIPLINARY SPECIALTY CONCERNED WITH INFLUENCING THE DESIGN OF EQUIPMENT SYSTEMS, FACILITIES, AND OPERATIONAL ENVIRONMENTS TO PROMOTE SAFE, EFFICIENT, AND RELIABLE OPERATOR PERFORMANCE. THE HUMAN FACTORS ASPECTS OF FIVE REPRESENTATIVE NUCLEAR POWER PLANT CONTROL ROOMS WERE EVALUATED USING SUCH METHODS AS A CHECKLIST GUIDED OBSERVATION SYSTEM BASED ON MILITARY STANDARDS, STRUCTURED INTERVIEWS WITH OPERATORS AND TRAINERS, DIRECT OBSERVATIONS OF OPERATOR BEHAVIOR, TASK ANALYSES, PROCEDURE EVALUATIONS, AND HISTORICAL ERROR ANALYSES. THE REVIEW HAS SURFACED A WIDE SPECTRUM OF HUMAN FACTORS PROBLEM AREAS AND NEEDED IMPROVEMENTS. THE STUDY RECOMMENDS THAT A DETAILED SET OF APPLICABLE HUMAN FACTORS STANDARDS BE DEVELOPED TO STIMULATE A UNIFORM AND SYSTEMATIC CONCERN FOR HUMAN FACTORS. IT IS FURTHER RECOMMENDED THAT DESIGN GUIDES BE DEVELOPED TO FACILITATE THE IMPLEMENTATION OF SUCH STANDARDS BOTH FOR NEW DESIGNS AND FOR UPGRADING EXISTING CONTROL ROOMS. A NUMBER OF RESEARCH AREAS ARE DELINEATED IN ORDER TO DEVELOP A MORE COMPREHENSIVE DATA BASE ON WHICH TO PREDICATE HUMAN FACTORS STANDARDS.

18-6-4-791 FATIGUE CRACK PROPAGATION IN NEUTRON IRRADIATED FERRITIC PRESSURE VESSEL STEELS
JAMES, L. A.
WESTINGHOUSE HANFORD COMPANY, RICHLAND, WASH.
THE RESULTS OF A NUMBER OF EXPERIMENTS DEALING WITH FATIGUE CRACK PROPAGATION IN IRRADIATED REACTOR PRESSURE VESSEL STEELS

ARE REVIEWED. THE STEELS INCLUDED ASTM ALLOYS A302B, A533B, A508-2, AND A543, AS WELL AS WELDMENTS IN A543 STEEL. FLUENCES AND IRRADIATION CONDITIONS WERE GENERALLY TYPICAL OF THOSE EXPERIENCED BY MOST POWER REACTORS. IN GENERAL, THE EFFECT OF NEUTRON IRRADIATION ON THE FATIGUE CRACK PROPAGATION BEHAVIOR OF THESE STEELS WAS NEITHER SIGNIFICANTLY BENEFICIAL NOR SIGNIFICANTLY DETRIMENTAL.

19-6-5-802 POWER PLANT DISCHARGES - TOWARD MORE REASONABLE EFFLUENT LIMITS ON CHLORINE
MATTICE, J. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A METHOD IS PRESENTED FOR RESTRICTING CHLORINE IN POWER-PLANT EFFLUENTS TO ENVIRONMENTALLY SAFE LEVELS. DEVELOPMENT OF THIS METHOD WAS STIMULATED BY THE CONTROVERSY BETWEEN ELECTRIC UTILITIES AND REGULATORY AGENCIES OVER THE JUSTIFICATION OF THE PRESENT UNIVERSALLY APPLIED LIMITS. THE SCIENTIFIC LITERATURE CONCLUSIVELY DEMONSTRATES THE EFFECTS OF PHYSICAL, CHEMICAL, AND BIOTIC FACTORS ON CHLORINE TOXICITY. THE METHOD PROPOSED INCLUDES THESE FACTORS, TO THE EXTENT CURRENTLY POSSIBLE, TO SET LIMITS BASED ON SITE SPECIFIC AQUATIC CONDITIONS AND PLANT DESIGN AND OPERATION SPECIFICATIONS. IN THESE EFFLUENT LIMITS, THE ORGANISMS CONSIDERED ARE THOSE WHICH ARE ENTRAINED INTO THE PLUME OR WHICH MAINTAIN THEMSELVES WITHIN THE PLUME DURING CHLORINATION. IN EACH INSTANCE THE TIME COURSE OF EXPOSURE CONCENTRATION IS DIVIDED INTO SMALL TIME INTERVALS, WEIGHTED MEAN CONCENTRATIONS FOR SUCCESSIVELY LARGER TIME INTERVALS FOLLOWING INITIAL EXPOSURE ARE THEN CALCULATED. EXPOSURES RESULTING FROM RELEASES AT VARIOUS LEVELS ARE COMPARED EITHER GRAPHICALLY OR MATHEMATICALLY WITH ACUTE AND CHRONIC MORTALITY THRESHOLDS TO FIND THE HIGHEST DISCHARGE CONCENTRATION THAT DOES NOT CAUSE MORTALITY. THE THRESHOLDS ARE DERIVED FROM EXISTING TOXICITY DATA AND ARE DIFFERENT FOR MARINE AND FRESHWATER ORGANISMS. THIS METHOD IS BASED ON THE LATEST LITERATURE AVAILABLE AND CAN INCORPORATE FURTHER DATA CONCERNING CHEMISTRY, TOXICITY, AND BEHAVIOR AS THEY BECOME AVAILABLE. THE METHOD ALSO IS AMENABLE TO COUPLING WITH MODELS OF CHEMICAL DISPERSION AND POPULATION DYNAMICS TO PERMIT MORE COMPLETE ANALYSIS. THIS APPROACH SERVES TO PERMIT USE OF CHLORINE FOR BIOFOULING CONTROL AT POWER PLANTS, WHILE ENSURING THAT THIS USE WILL NOT BE INIMICAL TO THE ENVIRONMENT.

19-1-1-1 THE STATE SIDE OF THE SITING EQUATION - SOME CASE STUDIES
RYAN, R. G.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THIS ARTICLE IS A BRIEF SURVEY OF STATE ACTIVITIES IN THE SITING OF NUCLEAR PRODUCTION AND UTILIZATION FACILITIES. IT CONSISTS OF MATERIAL GATHERED BY THE OFFICE OF STATE PROGRAMS IN CONNECTION WITH A STUDY CARRIED OUT IN ACCORDANCE WITH EFFICIENCY IN FEDERAL/STATE SITING ACTIONS - DETAILED STUDY PLAN (NUREG-0128), WHICH WAS AUTHORIZED BY THE NUCLEAR REGULATORY COMMISSION (NRC) IN SEPTEMBER 1976. THE FINAL REPORT, IMPROVING REGULATORY EFFECTIVENESS IN FEDERAL/STATE SITING ACTIONS (NUREG-0195), WAS PRESENTED TO THE NRC IN MAY 1977.

19-1-2-10 THERMAL SHOCK STUDIES ASSOCIATED WITH INJECTION OF EMERGENCY CORE COOLANT FOLLOWING A LOSS OF COOLANT ACCIDENT IN PWRS
CHEVERTON, R. D.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE THERMAL SHOCK RESULTING FROM INJECTION OF EMERGENCY CORE COOLANT FOLLOWING A LOSS OF COOLANT ACCIDENT MAY, UNDER CERTAIN CIRCUMSTANCES, RESULT IN PROPAGATION OF PREEXISTING CRACKS ON THE INNER SURFACE OF PRESSURIZED WATER REACTOR (PWR) PRESSURE VESSELS. AT OAK RIDGE NATIONAL LABORATORY, STUDIES BEING CONDUCTED IN CONNECTION WITH THIS PROBLEM INCLUDE THE THERMAL SHOCK TESTING OF 533-MM-OD BY 241-MM-ID STEEL TEST SPECIMENS. FOUR EXPERIMENTS HAVE BEEN CONDUCTED THUS FAR. THE RESULTS HAVE REVEALED NO SIGNIFICANT ANOMALIES AND TEND TO VALIDATE WITH REASONABLE ACCURACY THE METHODS OF ANALYSIS USED FOR PREDICTING THE BEHAVIOR OF PWR VESSELS UNDER THERMAL SHOCK CONDITIONS. OUR ANALYSIS OF THE PWR INDICATES THAT IN PRESENT GENERATION AND FUTURE PWR VESSELS CRACK PROPAGATION WILL NOT OCCUR AS A RESULT OF THERMAL SHOCK, BUT IN OLDER VESSELS IT MAY. HOWEVER, IT APPEARS THAT A PHENOMENON KNOWN AS WARM PRESTRESSING WILL PREVENT EXCESSIVE CRACK PENETRATION.

19-1-2-20 THE REFLOODING PHASE OF THE LOCA IN PWRS I. CORE HEAT TRANSFER AND FLUID FLOW
YADIGAROGLU, G.
UNIVERSITY OF CALIFORNIA, BERKELEY, CALIF.
THIS IS THE FIRST OF TWO ARTICLES ON THE REFLOODING PHASE OF THE LOSS OF COOLANT ACCIDENT (LOCA) IN PRESSURIZED WATER REACTORS. (THE OTHER ARTICLE, PART II, IS SCHEDULED FOR VOL. 19, NO. 2.) THIS FIRST ARTICLE IS A GENERAL DESCRIPTION OF CORE BEHAVIOR DURING THE REFLOODING PHASE OF THE LOCA. A SUCCESSION OF HEAT TRANSFER AND TWO PHASE FLOW REGIMES MOVES ALONG THE ROD BUNDLE DURING REFLOODING OF THE CORE. PARAMETRIC RANGES AND OTHER FEATURES OF TRANSIENT REFLOODING EXPERIMENTS THAT HAVE BEEN CONDUCTED WITH ROD BUNDLES AND IN SIMPLE SINGLE CHANNEL GEOMETRIES ARE TABULATED. EXPERIMENTAL FINDINGS AND PARAMETRIC TRENDS ARE SUMMARIZED AND EXPLAINED. CORE HEAT TRANSFER AND HYDRODYNAMICS ANALYSIS METHODS INCORPORATED IN EMERGENCY CORE COOLING SYSTEM EVALUATION MODELS USED FOR LICENSING PURPOSES

ARE REVIEWED, AND THE WORK ON MORE ADVANCED MODELS THAT ATTEMPT TO ESTIMATE CORE HEAT TRANSFER COEFFICIENTS ON THE BASIS OF CALCULATED LOCAL FLOW CONDITIONS IS NOTED.

19-1-3-38 INTERNATIONAL CONFERENCE ON NUCLEAR SYSTEMS RELIABILITY ENGINEERING AND RISK ASSESSMENT
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
AN INTERNATIONAL MEETING OF SPECIALISTS CONCERNED WITH THE METHODOLOGIES FOR RELIABILITY ANALYSIS AND RISK ASSESSMENT WAS HELD IN GATLINBURG, TENN., JUNE 20-24, 1977. THEORETICAL AND APPLICABLE PRESENTATIONS TREATED STATE OF THE ART TECHNIQUES IN ANALYSIS AND ASSESSMENT, FOR THE MOST PART UTILIZING REFINEMENTS BASED ON FAULT TREE STRUCTURE. SEVERAL GENERAL CATEGORIES WERE IDENTIFIED FROM THE 34 PAPERS WITH SEVERAL AUTHORS CLAIMING SOME ABILITY AT TREATMENT OF COMMON CAUSE FAILURES.

19-1-4-43 LOFT EMERGENCY CORE-COOLING SYSTEM EXPERIMENTS - RESULTS FROM THE L1-4 EXPERIMENT
LEACH, L. P. + YBARRONDO, L. J.
IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO FALLS, IDAHO
RESULTS FROM EMERGENCY CORE COOLING SYSTEM EXPERIMENTS IN THE LOSS OF FLUID TEST FACILITY ARE DESCRIBED. THE EXPERIMENTAL RESULTS ARE PUT IN PERSPECTIVE BY COMPARING THEM WITH RESULTS FROM THE MUCH SMALLER SEMISCALE FACILITY AND PRETEST PREDICTIONS MADE WITH RELAP4/MOD5 COMPUTER CODE. EMPHASIS IS PLACED ON THE MOST RECENT LOSS OF FLUID TEST NONNUCLEAR EXPERIMENT, DESIGNATED L1-4, IN WHICH THE EMERGENCY CORE COOLING WATER WAS INJECTED INTO THE REACTOR INLET PIPE, AS IT IS IN MANY COMMERCIAL NUCLEAR REACTORS. GENERAL SYSTEM BEHAVIOR DURING THE DECOMPRESSION, EMERGENCY CORE COOLING WATER MIXING PHENOMENON, AND EMERGENCY CORE COOLING WATER BYPASS ARE EVALUATED.

19-1-5-50 A SUMMARY OF SHALLOW LAND BURIAL OF RADIOACTIVE WASTES AT COMMERCIAL SITES BETWEEN 1962 AND 1976, WITH PROJECTIONS
HOLCOMB, W. F.
U.S. ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.
THE U.S. ENVIRONMENTAL PROTECTION AGENCY REQUESTED THE SIX STATES HAVING COMMERCIAL SHALLOW LAND BURIAL FACILITIES FOR OTHER THAN HIGH LEVEL RADIOACTIVE WASTES TO PROVIDE INVENTORIES OF THE TYPES AND QUANTITIES OF WASTES BURIED AT THESE SITES. COMPILATIONS AND INTERPRETATIONS OF THE INVENTORIES ARE PRESENTED IN TABLES AND FIGURES. PROJECTIONS TO THE YEAR 2000 ARE MADE AND COMPARED WITH OTHER PROJECTIONS OF THE QUANTITY OF FUEL CYCLE AND NONFUEL CYCLE WASTES TO BE DISPOSED OF BY SHALLOW LAND BURIAL. THESE PROJECTIONS ARE THEN COMPARED WITH THE ASSUMED AVAILABLE CAPACITY AND OPERATIONAL LIFE OF THE COMMERCIAL SITES. THE RESULTS OF THIS COMPARISON INDICATE THAT THE EXISTING SITES SHOULD HAVE ADEQUATE BURIAL CAPACITY UNTIL THE LATE 1990S.

19-1-5-60 FOURTH INTERNATIONAL CONGRESS OF THE INTERNATIONAL RADIATION PROTECTION ASSOCIATION
JACOBS, D. G.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE FOURTH INTERNATIONAL CONGRESS OF THE INTERNATIONAL RADIATION PROTECTION ASSOCIATION WAS HELD IN PARIS, FRANCE, APR. 24-30, 1977. THE CONGRESS WAS HOSTED BY THE SOCIETE FRANCAISE DE RADIOPROTECTION AND HAD AS ITS THEME 'RADIATION PROTECTION - AN EXAMPLE OF ACTION AGAINST MODERN HAZARDS.' THE MEETING WAS ATTENDED BY APPROXIMATELY 1200 SCIENTISTS REPRESENTING 25 COUNTRIES AND NUMEROUS INTERNATIONAL ORGANIZATIONS. ALL BUT 14 OF THE 222 PAPERS PRESENTED IN THE 30 ORAL SESSIONS AND ALL BUT 7 OF 119 PAPERS PRESENTED IN THE 7 POSTER SESSIONS WERE DISTRIBUTED IN THE PRINTED PROCEEDINGS AT THE MEETING. A BROAD SPECTRUM OF TOPICS WAS COVERED, RANGING FROM MOLECULAR AND CELLULAR BIOLOGY TO RADIOACTIVE WASTE MANAGEMENT AND EMERGENCY PLANS FOR NUCLEAR ACCIDENTS.

19-1-5-66 ENVIRONMENTAL SURVEILLANCE FOR NUCLEAR FACILITIES
HOELLER, D. W. + SELBY, J. M. + WAITE, D. A.
CORLEY, J. P.
HARVARD UNIVERSITY, BOSTON, MASS. / BATTELLE PACIFIC NORTHWEST LABORATORY, RICHLAND, WASH.
ONE OF THE PRIMARY GOALS OF ENVIRONMENTAL SURVEILLANCE PROGRAMS IN THE VICINITY OF NUCLEAR FACILITIES IS TO OBTAIN INFORMATION ESSENTIAL TO ASSESSING AND CONTROLLING DOSE RATES TO THE NEIGHBORING POPULATION. EXPERIENCE HAS SHOWN, HOWEVER, THAT ENVIRONMENTAL RADIONUCLIDE CONCENTRATIONS ARE FREQUENTLY SO LOW AND SO VARIABLE THAT DOSE ESTIMATES MUST BE BASED PRIMARILY ON IN-PLANT AND EFFLUENT MEASUREMENTS, COUPLED WITH SUITABLE CALCULATIONAL TECHNIQUES FOR EXTRAPOLATING SUCH DATA TO THE GENERAL ENVIRONMENT. ALTHOUGH THE NUMBER OF PATHWAYS BY WHICH EACH OF THE RELEASED RADIONUCLIDES MAY ULTIMATELY REACH THE POPULATION ARE NUMEROUS AND COMPLEX, IN MOST SITUATIONS THE PRIMARY CONTRIBUTORS TO THE POPULATION DOSE WILL CONSIST OF NO MORE THAN SIX RADIONUCLIDES MOVING THROUGH THREE OR FOUR PATHWAYS. CURRENT PROBLEMS ASSOCIATED WITH ENVIRONMENTAL SURVEILLANCE PROGRAMS INCLUDE (1) LACK OF A DEFINITION OF DE MINIMIS DOSE LEVELS FOR MEASUREMENT OR CALCULATION, (2) DEFICIENCIES IN QUALITY ASSURANCE, DATA TREATMENT, AND SOURCE IMPACT DEFINITION, (3) LACK OF PERIODIC IN-DEPTH REVIEW AND

REEVALUATION OF PROGRAMMATIC NEEDS, AND (4) LACK OF SUFFICIENT RESOURCES ON THE PART OF STATE AND LOCAL AGENCIES FOR PROVIDING AN INDEPENDENT CHECK ON THE DATA REPORTED BY NUCLEAR FACILITY OPERATORS.

19-1-5-91 AN EXPLOSION AND FIRE DURING CONVERSION OF LIQUID URANYL NITRATE TO SOLID URANIUM OXIDE
GRAY, L. W.
SAVANNAH RIVER LABORATORY, AIKEN, S.C.
DURING THE CONVERSION OF MOLTEN URANYL NITRATE TO SOLID URANIUM OXIDE AT THE SAVANNAH RIVER PLANT, A RAPID CHEMICAL REACTION OCCURRED IN A DENITRATOR AND EXPELLED THE CONTENTS, INCLUDING COMBUSTIBLE GASES, INTO THE PROCESS ROOM. THE GASES IGNITED AND CAUSED A GAS PHASE EXPLOSION AND FIRE. AN EXCESSIVE AMOUNT OF ORGANIC MATERIAL (ABOUT 120 LITERS OF TRIBUTYL PHOSPHATE IN THE FORM OF URANYL NITRATE ADDUCT) HAD BEEN UNINTENTIONALLY TRANSFERRED, ALONG WITH NORMAL PROCESS MATERIAL, THROUGH TWO EVAPORATORS TO THE DENITRATOR. DURING HEATING OF THE DENITRATOR CONTENTS, THE ORGANIC MATERIAL DECOMPOSED RAPIDLY BETWEEN 170C AND 210C, EMITTING COMBUSTIBLE AND NONCOMBUSTIBLE GASES THAT EJECTED THE DENITRATOR CONTENTS INTO THE DENITRATOR ROOM. THE GAS COLLECTED AT THE CEILING IN THE ROOM AND IGNITED WITH A LOW EXPLOSIVE FORCE. TWO EMPLOYEES SUSTAINED MINOR INJURIES, AND THERE WAS ABOUT $230,000 DAMAGE TO THE BUILDING AND EQUIPMENT.

19-2-1-135 RISKS IN TRANSPORTING MATERIALS FOR VARIOUS ENERGY INDUSTRIES
RHOADS, R. E. + JOHNSON, J. F.
BATTELLE PACIFIC NORTHWEST LABORATORIES, RICHLAND, WASH.
BATTELLE PACIFIC NORTHWEST LABORATORIES (PNL) IS CURRENTLY CONDUCTING A RESEARCH PROGRAM SPONSORED BY THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION TO ASSESS THE RISKS IN TRANSPORTING ENERGY MATERIALS. THE OBJECTIVE OF THIS PROGRAM IS TO USE A CONSISTENT METHODOLOGY TO ASSESS THE RISKS OF TRANSPORTING MATERIALS FOR ENERGY SYSTEMS WHICH ARE CURRENTLY IN USE AND FOR THOSE WHICH ARE BEING DEVELOPED OR PLANNED FOR THE FUTURE. THIS ARTICLE BRIEFLY REVIEWS THE BACKGROUND OF RISK ASSESSMENT, DESCRIBES THE RISK ASSESSMENT METHODOLOGY USED IN PNL'S TRANSPORTATION SAFETY STUDIES PROGRAM, SUMMARIZES THE WORK TO DATE, AND OUTLINES FUTURE PROGRAMS.

19-2-1-153 ANS TOPICAL MEETING ON THERMAL REACTOR SAFETY
BUCHANAN, J. R.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A TOPICAL MEETING ON THERMAL REACTOR SAFETY SPONSORED BY THE AMERICAN NUCLEAR SOCIETY WAS HELD IN SUN VALLEY, IDAHO, JULY 31-AUG. 4, 1977. PRESENTED WERE 120 PAPERS ON THE FOLLOWING TOPICS - PROBABILISTIC METHODS, COMMUNICATING REACTOR SAFETY, REACTOR SAFETY RESEARCH AND LICENSING, PLANT DIAGNOSTICS, OPERATION, RESPONSE TO ACCIDENT CONDITIONS, PREVENTION, AND MITIGATION OF ACCIDENT CONDITIONS, UNDERSTANDING THE NUCLEAR STEAM SUPPLY SYSTEM (NSSS) RESPONSE TO DESIGN BASIS EVENTS, CONTAINMENT AND PLANT DESIGN AGAINST EXTERNAL HAZARDS, AND FUEL BEHAVIOR, FISSION PRODUCT BEHAVIOR, AND RESEARCH ON CORE MELTDOWN. ONE THIRD OF THE PAPERS WERE ON THE NSSS RESPONSE TO DESIGN BASIS EVENTS, WITH EMPHASIS ON THE LOSS OF COOLANT ACCIDENT. A BRIEF REVIEW OF THE MEETING HIGHLIGHTS IS PRESENTED.

19-2-2-160 THE REFLOODING PHASE OF THE LOCA IN PWRS II. REWETTING AND LIQUID ENTRAINMENT
ELIAS, E. + YADIGAROGLU, G.
UNIVERSITY OF CALIFORNIA AT BERKELEY, BERKELEY, CALIF.
SURFACE REWETTING AND LIQUID DROPLET ENTRAINMENT PLAY AN IMPORTANT ROLE IN THE ANALYSIS OF THE REFLOODING PHASE OF THE LOSS OF COOLANT ACCIDENT IN PRESSURIZED WATER REACTORS. THE DEFINITIONS AND THE VARIOUS INTERPRETATIONS GIVEN TO THE REWETTING TEMPERATURE AND THE REWETTING MECHANISMS OF THE FUEL RODS ARE DISCUSSED. PUBLISHED MODELS OF THE AXIAL CONDUCTION CONTROLLED REWETTING PROCESS INCLUDE ONE DIMENSIONAL SOLUTIONS IN TWO AXIAL REGIONS, ONE DIMENSIONAL SOLUTIONS IN THREE AXIAL REGIONS WITH OR WITHOUT PRECURSORY COOLING, ONE AND TWO DIMENSIONAL NUMERICAL DIFFERENCE TECHNIQUES USING TEMPERATURE DEPENDENT HEAT TRANSFER COEFFICIENTS, AND ANALYTICAL TWO DIMENSIONAL SOLUTIONS. THE BASIC PHYSICAL ASSUMPTIONS AND THE NUMERICAL VALUES ASSIGNED TO THE VARIOUS PARAMETERS, AS WELL AS EMPIRICAL REWETTING CORRELATIONS, ARE DISCUSSED. THE PHYSICAL MECHANISMS FOR LIQUID DROPLET ENTRAINMENT AND ANALYTICAL FORMULATIONS OF THE CRITICAL GAS VELOCITY AND OF THE DROPLET DIAMETER AT THE ONSET OF ENTRAINMENT ARE REVIEWED.

19-2-2-176 LWR FUEL BEHAVIOR RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY
FISCHER, M. + OSBORNE, M. F.
GESELLSCHAFT FUR KERNFORSCHUNG, KARLSRUHE, FEDERAL REPUBLIC OF GERMANY
CONCURRENT WITH THE DEVELOPMENT IN THE FEDERAL REPUBLIC OF GERMANY OF LARGE LIGHT WATER REACTORS FOR ELECTRIC POWER PRODUCTION, A BROAD PROGRAM FOR INVESTIGATING THE SAFETY ASPECTS OF LARGE POWER REACTORS HAS BEEN ESTABLISHED. THIS REVIEW IS CONCERNED SPECIFICALLY WITH THE BEHAVIOR OF THE FUEL RODS AND BUNDLES UNDER VARIOUS ACCIDENT CONDITIONS, SUCH AS A LOSS OF COOLANT ACCIDENT, AN ANTICIPATED TRANSIENT WITHOUT SCRAM, AND A POWER COOLANT MISMATCH. THE PROPERTIES AND DEFORMATION CHARACTERISTICS OF THE ZIRCALOY CLADDING DURING TEMPERATURE TRANSIENTS IN STEAM ARE INVESTIGATED, ESPECIALLY

WITH RESPECT TO THEIR INFLUENCE ON ROD FAILURE (RESULTING IN FISSION PRODUCT RELEASE) AND POSTSHUTDOWN COOLABILITY (WHICH IS IMPORTANT IN AVOIDING CORE MELTDOWN). EXPERIMENTAL AND THEORETICAL EFFORTS ARE CLOSELY COORDINATED, WITH THE OBJECTIVE BEING THE DEVELOPMENT OF THE VERIFIED ANALYTICAL MODELS NEEDED TO RELIABLY PREDICT FUEL BEHAVIOR UNDER ANY SPECIFIC SET OF CONDITIONS OR SEQUENCE OF EVENTS.

19-2-4-193 EFFECT OF ENGINEERED SAFETY FEATURES ON THE RISK OF HYPOTHETICAL LMFBR ACCIDENTS
CYBULSKIS, P.
BATTELLE COLUMBUS LABORATORIES, COLUMBUS, OHIO
THE RISKS OF HYPOTHETICAL CORE DISRUPTIVE ACCIDENTS IN LIQUID METAL COOLED FAST BREEDER REACTORS WHICH INVOLVE MELT THROUGH OF THE REACTOR VESSEL ARE COMPARED FOR TWO PLANT DESIGNS - ONE DESIGN WITHOUT SPECIFIC PROVISIONS TO ACCOMMODATE SUCH AN ACCIDENT AND THE OTHER DESIGN WITH AN EX-VESSEL CORE CATCHER AND A CAVITY HOT LINER. THE APPROACH TO RISK ANALYSIS USED IS THAT DEVELOPED IN THE REACTOR SAFETY STUDY (WASH-1400). SINCE THE PROBABILITY OF OCCURRENCE OF SUCH AN EVENT HAS NOT BEEN EVALUATED, HOWEVER, INSIGHT INTO THE POTENTIAL RISK IS GAINED ONLY ON A RELATIVE BASIS. THE PRINCIPAL CONCLUSIONS OF THIS STUDY ARE - (1) ADDING A CORE CATCHER HOT LINER REDUCES THE PROBABILITY OF ACCIDENTS HAVING MAJOR CONSEQUENCES. (2) THE DEGREE TO WHICH HOT LINER CORE CATCHER SYSTEMS CAN REDUCE THE RISK OF MELT THROUGH ACCIDENTS IS LIMITED BY THE FAILURE PROBABILITY OF THESE SYSTEMS. (3) FRACTIONAL RADIOACTIVE RELEASES TO THE ENVIRONMENT IN THE LIQUID METAL COOLED FAST BREEDER REACTOR ACCIDENTS CONSIDERED ARE COMPARABLE TO THOSE FROM THE LIGHT WATER REACTORS EVALUATED IN WASH-1400. (4) SINCE SODIUM CONCRETE REACTIONS ARE A DOMINANT DRIVING FORCE DURING THE ACCIDENT, THE INTEGRITY OF THE CAVITY LINER IS AS IMPORTANT AS THE FUNCTION OF THE CORE CATCHER. (5) THERE MAY BE OTHER ACCIDENTS OR PATHS TO RADIOACTIVE RELEASES THAT ARE NOT AFFECTED BY THE ADDITION OF A HOT LINER CORE CATCHER.

19-2-5-204 PARAMETERIZATIONS FOR RESUSPENSION AND FOR WET AND DRY DEPOSITION OF PARTICLES AND GASES FOR USE IN RADIATION DOSE CALCULATIONS
SLINN, W. G. N.
OREGON STATE UNIVERSITY, CORVALLIS, OREG.
SOME COMMENTS ARE PRESENTED ABOUT METHODS AND ACCURACIES OF PARAMETERIZING PRECIPITATION SCAVENGING, DRY DEPOSITION, AND RESUSPENSION FOR USE IN BOTH ACCIDENTAL AND LONG TERM AVERAGE RADIATION DOSE CALCULATIONS. THE PRESENTATION EMPHASIZES WET, DRY, AND RESUSPENSION VELOCITIES. THE ACCURACIES OF THESE PARAMETERIZATIONS DECREASE WITH ATTEMPTS TO OBTAIN INCREASING TIME RESOLUTION. ANNUAL AVERAGE ESTIMATES FOR THE WET DEPOSITION VELOCITY ARE KNOWN TO WITHIN A FACTOR OF ABOUT 2 TO 5. SIMILARLY, ANNUAL AVERAGE ESTIMATES FOR THE DRY DEPOSITION VELOCITY ARE KNOWN TO WITHIN A FACTOR OF ABOUT 2 TO 5, EXCEPT WHEN THEY APPLY TO SUBMICRON PARTICLES AND SLIGHTLY REACTIVE GASES DEPOSITING ON VEGETATION. IN THESE CASES THERE IS AN ORDER OF MAGNITUDE UNCERTAINTY OR MORE, ASSOCIATED WITH THE RESUSPENSION VELOCITY PARAMETERIZATION OF RESUSPENSION. THERE ARE MANY ORDERS OF MAGNITUDE UNCERTAINTY. FURTHER RESEARCH AND AND ALTERNATIVE FORMULATIONS FOR DOSE CALCULATIONS ARE ENCOURAG AND ONE ALTERNATIVE IS OUTLINED.

19-2-5-220 EFFECTS OF RAINSTORMS AND RUNOFF ON CONSEQUENCES OF ATMOSPHERIC RELEASES FROM NUCLEAR REACTOR ACCIDENTS
RITCHIE, L. T. + BROWN, W. D. + WAYLAND, J. R.
SANDIA LABORATORIES, ALBUQUERQUE, N. MEX.
A PRELIMINARY MODEL DESCRIBING THE EFFECTS OF WASHOUT AND RUNOFF ON THE CONSEQUENCES OF A NUCLEAR REACTOR ACCIDENT IS PRESENTED. THE MOST IMPORTANT NEW FEATURE OF THIS STRUCTURED MODEL RELATIVE TO THE MODEL DESCRIBED IN REPORT WASH-1400 IS THE SPATIAL STRUCTURE OF RAINSTORMS AND RUNOFF CONSISTING OF FOUR LEVELS OF RAIN INTENSITY THAT ARE NORMALIZED BY RAIN-GAUGE DATA. THE PREDICTED CONCENTRATIONS OF RADIOACTIVITY AND RESULTANT HEALTH CONSEQUENCES OF THE STRUCTURED MODEL ARE COMPARED TO THOSE OF THE MODEL IN WASH-1400 FOR SIMPLIFIED RAINSTORMS WITH FIXED METEOROLOGICAL CONDITIONS AND FOR AN ACTUAL RAINSTORM. RUNOFF AND THE SPATIAL STRUCTURE OF THE RAIN IN THE NEW MODEL CAN RESULT IN HEALTH CONSEQUENCES THAT ARE SIGNIFICANTLY DIFFERENT FROM THOSE OF THE WASH-1400 MODEL.

19-3-1-269 ENERGY INVESTMENT IN NUCLEAR POWER PLANTS
MAYS, G. T.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE ENERGY INVESTMENT IN TERMS OF ELECTRICAL AND THERMAL ENERGY REQUIREMENTS FOR NUCLEAR POWER PLANTS IS EXAMINED. THE TOTAL LIFETIME ENERGY INPUTS REQUIRED FOR A 1000-MW(E) PLANT BASED ON A 30-YEAR PLANT LIFETIME AND 0.75 PLANT FACTOR ARE PRESENTED FOR SEVERAL PRESSURIZED WATER REACTOR (PWR) AND BOILING WATER REACTOR (BWR) SYSTEMS, TWO HIGH TEMPERATURE GAS COOLED REACTOR (HTGR) SYSTEMS, AND ONE HEAVY WATER REACTOR (HWR) SYSTEM. THE ENERGY ANALYSES REVIEWED HERE HAVE DEMONSTRATED THAT THE ENERGY EXPENDITURES FOR THE VARIOUS REACTOR SYSTEMS ARE VERY MUCH LESS THAN THE ENERGY PRODUCED BY THE REACTORS AND THAT THE INITIAL ENERGY INVESTMENTS ARE RECOVERED IN A SHORT TIME AFTER STARTUP SEVERAL MONTHS TO 2 YEARS. THE ENERGY REQUIREMENTS ASSOCIATED WITH THE INDIVIDUAL PROCESSES, SUCH AS MINING, ENRICHMENT, CONSTRUCTION, AND WASTE DISPOSAL, ARE TABULATED FOR TWO DIFFERENT FUEL CYCLES FOR A PWR AND A BWR. THE ENRICHING

PROCESS IS BY FAR THE LARGEST COMPONENT OF THE ELECTRICAL REQUIREMENTS, REPRESENTING 85 TO 90 PERCENT OF THE TOTAL ELECTRICAL ENERGY INVESTMENT. THE ENERGY USED IN CONSTRUCTING AND OPERATING THE REACTOR CONSTITUTES THE LARGEST SINGLE INVESTMENT OF THERMAL ENERGY, REPRESENTING 50 PERCENT OF THE TOTAL THERMAL ENERGY REQUIREMENTS.
RESULTS OF SEVERAL ANALYSES ARE EXAMINED AND COMPARISONS MADE BETWEEN NUCLEAR POWER PLANTS, A COAL PLANT, AND A SOLAR THERMAL CONVERSION PLANT.

19-3-1-291 FIFTH NRC WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE SUMMARIZES THE FIFTH WATER REACTOR SAFETY RESEARCH INFORMATION MEETING, SPONSORED BY THE NUCLEAR REGULATORY COMMISSION'S DIVISION OF REACTOR SAFETY RESEARCH AND HELD AT THE NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD., NOV. 7-11, 1977. PRESENTED AT THE MEETING WERE 126 PAPERS DIVIDED AMONG THE FOLLOWING FIVE RESEARCH PROGRAM AREAS - (1) LOSS OF COOLANT ACCIDENT STUDIES, (2) METALLURGY AND MATERIALS RESEARCH PROGRAM, (3) FUEL BEHAVIOR RESEARCH PROGRAM, (4) ANALYSES DEVELOPMENT PROGRAM, AND (5) REACTOR OPERATIONAL SAFETY PROGRAM. IN ADDITION, THE MEETING INCLUDED NUMEROUS WORKSHOPS ON SELECTED TOPICS. AMONG THE MANY PRESENTATIONS WERE SIX INVITED PAPERS ON SAFETY RESEARCH IN SEVERAL FOREIGN COUNTRIES AND NUMEROUS PAPERS ON RESEARCH SPONSORED BY THE ELECTRIC POWER RESEARCH INSTITUTE. FROM ALL THIS WORK, THE EVIDENCE CONTINUES TO MOUNT REGARDING THE EXTENT OF THE CONSERVATIVE APPROACH TO NUCLEAR SAFETY THAT IS TAKEN IN THIS COUNTRY.

19-3-1-292 WATER REACTOR SAFETY RESEARCH PROGRAM - APPLICATION OF RESEARCH RESULTS
TONG, L. S.
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
(EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED FROM A PAPER PRESENTED BY DR. L. S. TONG AT THE FIFTH WATER REACTOR SAFETY RESEARCH INFORMATION MEETING (SEE PRECEDING ARTICLE). IT DESCRIBES THE PHILOSOPHY BEHIND THE NRC WATER REACTOR SAFETY RESEARCH PROGRAM, WHILE HIGHLIGHTING THE ACCOMPLISHMENTS OVER THE PAST YEAR (NOMINALLY FY 1977). FOR PERSONS DESIRING MORE BACKGROUND INFORMATION, DR. TONG COAUTHORED (WITH G. L. BENNETT) A COMPREHENSIVE REVIEW OF THE NRC WATER REACTOR SAFETY RESEARCH PROGRAM, WHICH WAS PUBLISHED IN NUCLEAR SAFETY, 18(1) - 1-39 (1977).)

19-3-1-297 NUCLEAR STANDARDS IN THE FEDERAL REPUBLIC OF GERMANY - THE DIN NUCLEAR STANDARDS COMMITTEE
BECKER, K.
FEDERAL REPUBLIC OF GERMANY
WITHIN THE NUCLEAR TECHNOLOGY STANDARDS COMMITTEE (NKE) OF THE GERMAN STANDARDS INSTITUTE (DIN), ABOUT 40 WORKING GROUPS WITH SOME 400 EXPERTS, REPRESENTING LICENSING AND INSPECTION AUTHORITIES, MANUFACTURERS, UTILITIES, AND OTHER INTERESTED PARTIES, HAVE DEVELOPED ALMOST 100 NUCLEAR STANDARDS AND DRAFT STANDARDS. THE MAIN AREAS OF ACTIVITY ARE COMMUNICATIVE PRINCIPLES, RADIATION PROTECTION TECHNOLOGY, THE FUEL CYCLE, AND, MOST IMPORTANT, REACTOR SAFETY AND TECHNOLOGY. EFFORTS IN THIS AREA ARE CLOSELY CONNECTED WITH THOSE OF THE MORE RECENTLY ESTABLISHED SEMIGOVERNMENTAL NUCLEAR TECHNOLOGY BOARD (KTA), WHICH IS IN CHARGE OF COORDINATING AND APPROVING BASIC NATIONAL REACTOR SAFETY STANDARDS. INTERNATIONAL NKE ACTIVITIES FOCUS ON SERVING AS THE NATIONAL COUNTERPART FOR THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION'S (ISO'S) NUCLEAR TECHNOLOGY COMMITTEE (TC85), WHOSE SECRETARIAT HAS RECENTLY BEEN TRANSFERRED FROM THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) TO DIN/NKE'S. THE SCOPE, PROGRESS, AND PROBLEMS OF NUCLEAR STANDARDS WORK DURING THE PAST FEW YEARS IN THE FEDERAL REPUBLIC OF GERMANY ARE BRIEFLY DESCRIBED.

19-3-2-305 PROBABILITY AND RISK ASSESSMENT - THE SUBJECTIVISTIC VIEWPOINT AND SOME SUGGESTIONS
APOSTOLAKIS, G.
UNIVERSITY OF CALIFORNIA, LOS ANGELES, CALIF.
THE PURPOSE OF THIS PAPER IS TO INVESTIGATE THE PHILOSOPHICAL BASIS FOR THE USE OF THE CONCEPT OF PROBABILITY IN RISK ASSESSMENT STUDIES. IT IS ARGUED THAT THE SUBJECTIVISTIC INTERPRETATION OF PROBABILITY (I.E., PROBABILITY AS A MEASURE OF DEGREE OF BELIEF) IS THE APPROPRIATE FRAMEWORK FOR SUCH STUDIES. THE RELATIONSHIP BETWEEN RELATIVE FREQUENCY AND SUBJECTIVE PROBABILITY IS EXAMINED, AND THE IMPORTANT CONCEPTS OF COHERENCE AND EXCHANGEABILITY ARE DISCUSSED. FINALLY, THE IMPLICATIONS OF ADOPTING THE SUBJECTIVISTIC INTERPRETATION ARE INVESTIGATED, AND SOME SUGGESTIONS STEMMING FROM THE REQUIREMENT OF COHERENCE ARE GIVEN, WHICH ARE USEFUL WHEN LOW PROBABILITIES OR FREQUENCIES ARE ASSESSED.

19-3-2-316 CLINCH RIVER BREEDER REACTOR PLANT SAFETY STUDY
PIPER, H. B. + CONRADI, L. L. + BUHL, A. R.
WOOD, P. J. + LEAVER, D. E. W.
PROJECT MANAGEMENT CORPORATION, OAK RIDGE, TENN. / WESTINGHOUSE ELECTRIC CORPORATION, MONROEVILLE, PA. / SCIENCE APPLICATIONS, INC., PALO ALTO, CALIF.
THIS ARTICLE PRESENTS A REVIEW AND DISCUSSION OF THE OBJECTIVES, METHODS, TECHNIQUES, AND RESULTS OF A SAFETY STUDY THAT WAS CONDUCTED FOR THE CLINCH RIVER BREEDER REACTOR (CRBR)

PLANT. THE OBJECTIVES OF THE STUDY WERE (1) TO PROVIDE A REALISTIC ASSESSMENT OF ACCIDENT RISKS TO THE PUBLIC ASSOCIATED WITH OPERATION OF THE CRBR, (2) TO PLACE THOSE IDENTIFIED RISKS IN PERSPECTIVE WITH OTHER LOCAL SOCIETAL RISKS, AND (3) TO AID IN DETERMINING WHETHER ACCIDENT RISKS FROM THE CRBR ARE COMPARABLE TO THOSE OF PREVIOUSLY LICENSED REACTORS.
ACHIEVEMENT OF THE OBJECTIVES OF THIS STUDY HAS REQUIRED IDENTIFICATION OF SIGNIFICANT CONTRIBUTORS TO RISK IN A LOGICAL AND ORDERLY MANNER. CONSIDERATION OF A COMPREHENSIVE SET OF ACCIDENT INITIATORS, INCLUSION OF EXPERIENCE DATA, RELIANCE ON PROVEN METHODS AND TECHNIQUES, EVALUATION OF A WIDE RANGE OF RADIONUCLIDE RELEASES AND ASSOCIATED HEALTH EFFECTS, AND UTILIZATION OF EXPERIENCED RISK ANALYSTS ARE THE SALIENT ELEMENTS EMPLOYED IN THE SYSTEMATIC APPROACH TO THIS STUDY. THIS, TOGETHER WITH HEAVY RELIANCE ON EXPERIENCE GAINED DURING YEARS OF LWR DESIGN, LICENSING, AND OPERATION, PROVIDES REASONABLE ASSURANCE THAT THE STUDY OBJECTIVES HAVE BEEN ACHIEVED.
THE RESULTS OF THE CRBR PLANT SAFETY STUDY INDICATE THAT THE RISK ARISING FROM THE OPERATION OF THE CRBR PLANT IS SMALL IN COMPARISON TO OTHER LOCAL SOCIETAL RISKS AND THAT THE RISK FROM THE CRBR PLANT IS COMPARABLE TO THE RISK FROM PREVIOUSLY LICENSED NUCLEAR POWER PLANTS, AS IDENTIFIED IN THE REACTOR SAFETY STUDY.

19-3-3-330 RELIABILITY OF D-C POWER SUPPLIES
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE RELIABILITY OF THE D-C POWER SYSTEM IN NUCLEAR PLANTS AND THE ADEQUACY OF THE NUCLEAR REGULATORY COMMISSION (NRC) REQUIREMENTS FOR THIS SYSTEM HAVE BEEN QUESTIONED BY SAFETY ANALYSTS. CONCERN WAS EXPRESSED THAT FAILURE OF THE D-C SYSTEM WOULD CONCURRENTLY ISOLATE THE PLANT FROM THE EXTERNAL A-C POWER GRID, THE ON SITE EMERGENCY A-C SYSTEM, THE CONTROL FUNCTIONS ASSOCIATED WITH TURBINE DRIVEN PUMPS, AND ALL PROCESS INDICATION AND RECORDING FUNCTIONS, WITH THE RESULT THAT REMOVAL OF DECAY HEAT WITHOUT FUEL AND/OR CONTAMINATED DAMAGE MIGHT NOT BE POSSIBLE. THIS ARTICLE OUTLINES THE POSTULATED SCENARIO, REVIEWS THE TECHNICAL BACKGROUND ON THE DESIGN AND CRITERIA FOR D-C POWER SYSTEMS AS WELL AS THE OPERATING EXPERIENCE WITH SUCH SYSTEMS, AND PRESENTS THE NRC STAFF'S VIEW AND POSITION. IT FURTHER DELINEATES THE SAFETY SIGNIFICANCE OF SUCH FAILURES. THE BASIS FOR THE STAFF'S VIEW ON THE LIKELIHOOD OF THE POSTULATED SCENARIO, AND A PROPOSAL FOR ADDITIONAL TECHNICAL STUDIES.

19-3-4-339 THE SODIUM LOOP SAFETY FACILITY
GARTSIDE, C. H. + BEZELLA, W. A. + THOMPSON, D. H.
LENNOX, D. H. + TESSIER, J. P.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILL.
AS THE ONLY FACILITY IN THE UNITED STATES CAPABLE OF CONDUCTING SAFETY TESTS ON RELATIVELY LARGE, FULL LENGTH LIQUID METAL FAST BREEDER REACTOR (LMFBR) FUEL ASSEMBLIES AT STEADY STATE POWER LEVELS, THE SODIUM LOOP SAFETY FACILITY (SLSF) IS AN IMPORTANT PART OF THE LMFBR SAFETY PROGRAM. THE IN PILE EXPERIMENTS THAT BEGAN IN SEPTEMBER 1975 IN THE ENGINEERING TEST REACTOR (ETR) ARE PROVIDING DATA NEEDED FOR ASSESSMENT OF CRITICAL SAFETY QUESTIONS. PRESENTED IN THIS ARTICLE ARE DESCRIPTIONS OF THE FACILITY, ITS EXPERIMENTAL CAPABILITIES, AND THE OVERALL RESEARCH PROGRAM.

19-3-5-356 HIGH LEVEL NUCLEAR WASTE MANAGEMENT IN THE UNITED STATES - A TIME FOR DECISIONS
MALARO, J. C.
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
SINCE THE LATE 1950S, KNOWLEDGEABLE EXPERTS HAVE INSISTED THAT TECHNOLOGY EXISTS FOR THE SAFE DISPOSAL OF HIGH LEVEL RADIOACTIVE WASTES BUT THAT A MEANS FOR SAFE DISPOSAL HAS YET TO BE DEMONSTRATED. SAFE DISPOSAL OF THESE WASTES IS THE PRINCIPAL PUBLIC CONCERN ASSOCIATED WITH THE USE OF NUCLEAR POWER. THE ABILITY OF INDUSTRY OR GOVERNMENT TO SOLVE THIS PROBLEM HAS BEEN QUESTIONED BY MANY. SOME CRITICS ARE DEMANDING THAT LICENSING OF NUCLEAR POWER PLANTS BE SUSPENDED UNTIL SAFE AND EFFECTIVE DISPOSAL OF HIGH LEVEL RADIOACTIVE WASTE HAS BEEN DEMONSTRATED. AN INTENSE, COORDINATED, AND WELL FUNDED FEDERAL EFFORT TO SOLVE THIS PROBLEM IS UNDER WAY. NOW SOME DECISIONS ARE NEEDED.

19-3-6-369 THREE YEARS OF PHENIX OPERATION
MEGY, J. M. P. + CONTE, F. + GODDET, J. L.
COMMISSARIAT A L'ENERGIE ATOMIQUE, SCALAY, FRANCE
PHENIX IS A 250-MW(E) SODIUM COOLED PROTOTYPE FAST BREEDER REACTOR, WHICH WAS BUILT BY THE FRENCH ATOMIC ENERGY COMMISSION AND ELECTRICITE DE FRANCE AND HAS BEEN IN COMMERCIAL OPERATION SINCE THE SUMMER OF 1974. THIS ARTICLE REVIEWS THE OPERATIONAL HISTORY OF PHENIX, WHICH MAY BE DIVIDED INTO TWO PHASES. THE FIRST 2 YEARS, BEING RELATIVELY TROUBLE FREE, PERMITTED THE AMASSING OF IMPRESSIVE OPERATIONAL STATISTICS. DURING THE THIRD YEAR, WHEN COMPONENT FAILURES WERE EXPERIENCED AND WHEN THE REACTOR WAS OPERATED WITH ONE LOOP OUT OF SERVICE, VALUABLE INFORMATION ON PLANT MAINTENANCE WAS OBTAINED. OPERATING DATA ARE ALSO GIVEN FOR THE FIRST 3 YEARS OF OPERATION.

19-4-1-411 FRENCH SAFETY STUDIES OF PRESSURIZED WATER REACTORS
HINGGI, C.
ADJOINT AU CHEF DU SERVICE D'ETUDES TECHNIQUES DE SURETE NUCLEARE
FRANCE
SINCE THE FRENCH NUCLEAR PROGRAM IS BASED MAINLY ON PRESSURIZED WATER REACTORS (PWRS), WITH 25,300 MW(E) UNDER CONSTRUCTION, MOST OF THE NUCLEAR RESEARCH AND DEVELOPMENT IN FRANCE IS DEVOTED TO THE SPECIFIC SAFETY PROBLEMS OF PWRS. THIS ARTICLE IS A BRIEF REVIEW OF THAT PROGRAM, WHICH IS CURRENTLY FUNDED AT ABOUT $35 MILLION (IN U.S. DOLLARS) PER YEAR. THE PRINCIPAL AREAS OF RESEARCH, AS DISCUSSED HERE, INCLUDE FUEL ELEMENT BEHAVIOR, THE PRIMARY SYSTEM, PROBABILITY STUDIES, AND RADIOLOGICAL SAFETY STUDIES.

19-4-1-427 ANS EXECUTIVE CONFERENCE ON SAFEGUARDS
JENKINS, J. D.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE AMERICAN NUCLEAR SOCIETY EXECUTIVE CONFERENCE ON SAFEGUARDS IS REVIEWED. THE MEETING, WHICH WAS HELD ON OCT. 16-19, 1977, AT HYANNIS, CAPE COD, MASS., FEATURED PAPERS ON INTERNATIONAL SAFEGUARDS BY BOTH U.S. GOVERNMENT REPRESENTATIVES AND A NUMBER OF FOREIGN SPEAKERS. U.S. DOMESTIC SAFEGUARDS ISSUES, WHICH INCLUDED PROBLEMS INVOLVING PHYSICAL PROTECTION AND MATERIAL CONTROL AND ACCOUNTABILITY, WERE ALSO DISCUSSED BY REPRESENTATIVES FROM THE NUCLEAR REGULATORY COMMISSION AND INDUSTRY. IT WAS GENERALLY AGREED BY ALL SPEAKERS ADDRESSING THE INTERNATIONAL SAFEGUARDS ISSUE THAT MULTINATIONAL TREATIES AND CONTROLS (AS OPPOSED TO UNILATERAL AD HOC AGREEMENTS) WERE THE PREFERRED ROUTE TO PROLIFERATION RESISTANT NUCLEAR COMMERCE AND THAT THE INTERNATIONAL ATOMIC ENERGY AGENCY WAS THE LOGICAL BODY TO ADMINISTER AND OVERSEE THE REQUIRED INSPECTIONS. THERE WAS SOME DIVERGENCE OF OPINION BETWEEN THE FOREIGN AND U.S. PARTICIPANTS ON THE ISSUE OF PLUTONIUM RECYCLING, THE FORMER GROUP ASSUMING THAT THE INTERNATIONAL SAFEGUARDS SYSTEM WOULD HAVE TO CONFRONT THE PROBLEMS ASSOCIATED WITH PLUTONIUM RECYCLING DIRECTLY, AND THE U.S. SPEAKERS HELD OUT THE HOPE OF A LESS PROLIFERATION PRONE, AND HENCE MORE EASILY SAFEGUARDED, FUEL CYCLE. ON DOMESTIC SAFEGUARDS TOPICS, SPEAKERS FROM THE NUCLEAR REGULATORY COMMISSION AND THE DEPARTMENT OF ENERGY DESCRIBED SPECIFIC PROGRAMS UNDER WAY TO COUNTER AND CONTROL SUBNATIONAL TERRORIST THREATS AND TO ENSURE ACCURATE MATERIAL ACCOUNTING AND CONTROL. INDUSTRY SPEAKERS ADDRESSING DOMESTIC SAFEGUARDS ACQUIESCED TO THE REALITY OF THE PROBLEM BUT POINTED OUT THE NEED FOR WELL DEFINED PERFORMANCE CRITERIA AND STATIC REGULATORY GUIDELINES.

19-4-1-433 NRC SAFETY RESEARCH PROGRAM - A CRITIQUE AND AN EXTENSION
ADAPTED BY THE NUCLEAR SAFETY
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE - TWO RECENT REPORTS ARE UNIQUELY CONCERNED WITH THE NUCLEAR SAFETY RESEARCH PROGRAM OF THE NUCLEAR REGULATORY COMMISSION (NRC) IN THAT BOTH ARE IN RESPONSE TO CONGRESSIONAL MANDATES. ONE REPORT, IN DECEMBER 1977, IS BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS AND IS ENTITLED REVIEW AND EVALUATION OF THE NUCLEAR REGULATORY COMMISSION SAFETY RESEARCH PROGRAM. THE SECOND REPORT, DRAFTED EARLY THIS YEAR, IS BY THE NRC STAFF AND IS ENTITLED PLAN FOR RESEARCH TO IMPROVE THE SAFETY OF LIGHT WATER NUCLEAR POWER PLANTS. ALTHOUGH THE GENESES OF THE TWO REPORTS ARE SOMEWHAT DIFFERENT, TO SOME EXTENT BOTH REPORTS ARE CRITIQUES OF THE PRESENT NRC SAFETY RESEARCH PROGRAM, AND THEY BOTH CONTAIN RECOMMENDATIONS FOR ADDITIONAL RESEARCH. HOWEVER, THE LATTER REPORT EMPHASIZES SYSTEM IMPROVEMENTS, ALTHOUGH IT IS RESTRICTED TO LIGHT WATER REACTORS. THIS ARTICLE PRESENTS A BRIEF RESUME OF BOTH DOCUMENTS.

19-4-2-440 RESPONSE OF UNIRRADIATED AND IRRADIATED PWR FUEL RODS TESTED UNDER POWER COOLING MISMATCH CONDITIONS
MACDONALD, P. E. + QUAPP, W. J. + HEMNER, A. S.
MARTINSON, Z. R. + MCCARDELL, R. K.
EG+G IDAHO, INC., IDAHO FALLS, IDAHO
THIS REPORT SUMMARIZES THE RESULTS FROM THE SINGLE ROD POWER COOLING MISMATCH (PCM) AND IRRADIATION EFFECTS (IE) TESTS CONDUCTED TO DATE IN THE POWER BURST FACILITY (PBF) AT THE U.S. DEPARTMENT OF ENERGY'S IDAHO NATIONAL ENGINEERING LABORATORY. THIS WORK WAS PERFORMED FOR THE U.S. NUCLEAR REGULATORY COMMISSION UNDER CONTRACT TO THE DEPARTMENT OF ENERGY. THESE TESTS ARE PART OF THE NUCLEAR REGULATORY COMMISSION'S FUEL BEHAVIOR PROGRAM, WHICH IS DESIGNED TO PROVIDE DATA FOR THE DEVELOPMENT AND VERIFICATION OF ANALYTICAL FUEL BEHAVIOR MODELS THAT ARE USED TO PREDICT FUEL RESPONSE TO ABNORMAL OR POSTULATED ACCIDENT CONDITIONS IN COMMERCIAL LIGHT WATER REACTORS (LWRS). THE MECHANICAL, CHEMICAL, AND THERMAL RESPONSE OF BOTH PREVIOUSLY UNIRRADIATED AND PREVIOUSLY IRRADIATED LWR TYPE FUEL RODS TESTED UNDER POWER COOLING MISMATCH CONDITIONS IS DISCUSSED. A BRIEF DESCRIPTION OF THE TEST DESIGNS IS PRESENTED. THE RESULTS OF THE PCM THERMAL HYDRAULIC STUDIES ARE SUMMARIZED. PRIMARY EMPHASIS IS PLACED ON THE BEHAVIOR OF THE FUEL AND CLADDING DURING AND AFTER STABLE FILM BOILING.

19-4-3-469 SECOND SPECIALISTS MEETING ON REACTOR NOISE
BOUTH, R. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
GATLINBURG, TENN., WAS THE SITE OF THE SECOND SPECIALISTS MEETING ON REACTOR NOISE (SMORN-II) WHICH TOOK PLACE ON SEPT. 19-23, 1977. IN CONTRAST TO SMORN-I WHICH SUCCESSFULLY COVERED THE STATUS OF NOISE ANALYSIS IN BOTH ZERO POWER AND POWER REACTORS, SMORN-II PLACED EMPHASIS ON PRACTICAL APPLICATIONS OF NOISE ANALYSIS FOR THE PURPOSE OF INCREASING THE SAFETY AND AVAILABILITY OF NUCLEAR POWER PLANTS. FIFTY SEVEN PAPERS WERE PRESENTED TO THE 117 DELEGATES AND APPROXIMATELY 30 VISITORS WHO REPRESENTED 25 COUNTRIES AND INTERNATIONAL ORGANIZATIONS. AN IMPORTANT CONCLUSION OF THE CONFERENCE WAS THAT NOISE ANALYSIS TECHNIQUES HAVE PROVED TO BE SUCCESSFUL AND COST EFFECTIVE IN SOLVING SURVEILLANCE, DIAGNOSTIC, AND SAFETY RELATED PROBLEMS OF NUCLEAR POWER STATIONS. EQUALLY IMPORTANT WERE THE NEW AND CHALLENGING APPLICATIONS THAT WERE IDENTIFIED.

19-4-4-473 RECENT ADVANCES IN ALTERNATE ECCS STUDIES FOR PRESSURIZED WATER REACTORS
CHON, W. Y.
STATE UNIVERSITY OF NEW YORK AT BUFFALO, NEW YORK
RESEARCH AND DEVELOPMENT WORK ON ALTERNATE METHODS IS CURRENTLY UNDER WAY TO IMPROVE THE PERFORMANCE OF EXISTING EMERGENCY CORE COOLING SYSTEMS (ECCSS) FOR PRESSURIZED WATER REACTORS (PWRS). RECENT ADVANCES IN THIS AREA IN THE UNITED STATES AND ABROAD ARE REVIEWED.

19-4-5-480 PLANNING AND VALIDATION OF ENVIRONMENTAL SURVEILLANCE PROGRAMS AT OPERATING NUCLEAR POWER PLANTS
EICHHOLZ, G. G.
GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GA.
THE CONDUCT OF THE OPERATIONAL PHASE OF THE ENVIRONMENTAL SURVEILLANCE PROGRAMS AT NUCLEAR POWER PLANTS ENTAILS A WIDE VARIETY OF ECOLOGICAL STUDIES AND ANALYSES OF LOW LEVEL RADIOACTIVE SAMPLES. UNLESS A CLOSE REIN IS KEPT TO ENSURE THAT SAMPLES ARE REPRESENTATIVE IN NATURE AND COUNTING TIMES AND ACTIVITIES ARE COMMENSURATE WITH THE ACCURACY SOUGHT, MUCH OF THAT WORK MAY BE MEANINGLESS AND MAY MERELY SERVE TO MEET REGULATORY REPORTING REQUIREMENTS.
IT IS RECOMMENDED THAT AN ACTION LEVEL PROGRAM BE ADOPTED WHEREBY ONLY THE MOST SIGNIFICANT SAMPLES ARE COLLECTED AND ANALYSED DURING ROUTINE OPERATIONS, WITH PROVISIONS TO STEP UP THE FREQUENCY OF SAMPLING AND EXTEND SAMPLE LOCATIONS WHENEVER EFFLUENT RELEASES EXCEED CERTAIN FRACTIONS OF SET LIMITS.

19-4-5-497 RADIOLOGICAL IMPACT OF AIRBORNE EFFLUENTS OF COAL FIRED AND NUCLEAR POWER PLANTS
MCBRIDE, J. P. + MOORE, R. E. + WITHERSPOON, J. P.
BLANCO, R. E.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE RADIOLOGICAL IMPACT OF NATURALLY OCCURRING RADIONUCLIDES IN AIRBORNE EFFLUENTS OF A MODEL COAL FIRED STEAM PLANT (1000 MW(E)) IS EVALUATED, ASSUMING A RELEASE TO THE ATMOSPHERE OF 1 PERCENT OF THE ASH IN THE COAL BURNED, AND COMPARED WITH THE IMPACT OF RADIOACTIVE MATERIALS IN THE AIRBORNE EFFLUENTS OF MODEL LIGHT WATER REACTORS (1000 MW(E)). THE PRINCIPAL EXPOSURE PATHWAY FOR RADIOACTIVE MATERIALS RELEASED FROM BOTH TYPES OF PLANTS IS INGESTION OF CONTAMINATED FOODSTUFFS. FOR NUCLEAR PLANTS, IMMERSION IN THE AIRBORNE EFFLUENTS IS ALSO A SIGNIFICANT FACTOR IN THE DOSE COMMITMENT. ASSUMING THAT THE COAL BURNED CONTAINS 1 PPM URANIUM AND 2 PPM THORIUM TOGETHER WITH THEIR DECAY PRODUCTS AND USING THE SAME IMPACT ANALYSIS METHODS USED IN EVALUATING NUCLEAR FACILITIES, THE MAXIMUM INDIVIDUAL DOSE COMMITMENTS FROM THE COAL PLANT FOR THE WHOLE BODY AND MOST ORGANS (EXCEPT THE THYROID) ARE SHOWN TO BE GREATER THAN THOSE FROM A PRESSURIZED WATER REACTOR AND, WITH THE EXCEPTION OF THE BONE AND KIDNEY DOSES, LESS THAN THOSE FROM A BOILING WATER REACTOR, WITH THE EXCEPTION OF THE BONE DOSE. THE MAXIMUM INDIVIDUAL DOSE COMMITMENTS FROM THE COAL PLANT ARE LESS THAN THE NUMERICAL DESIGN GUIDELINE LIMITS LISTED IN 10 CFR 50, APPENDIX I, FOR LIGHT WATER REACTORS. POPULATION DOSE COMMITMENTS FROM THE COAL PLANT ARE HIGHER THAN THOSE FROM EITHER NUCLEAR PLANT, EXCEPT FOR THE THYROID DOSE FROM THE BOILING WATER REACTOR.

19-4-6-502 NRC REVIEW OF LICENSED OPERATOR REQUALIFICATION PROGRAMS FOR NUCLEAR POWER PLANTS
COOLEY, R. A.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
PRESENTED HERE ARE THE RESULTS OF NUCLEAR REGULATORY COMMISSION (NRC) AUDITS OF THE LICENSED OPERATOR REQUALIFICATION PROGRAMS AT NUCLEAR POWER PLANTS. THE REQUALIFICATION PROGRAMS HAVE BEEN IN EFFECT FOR A LITTLE OVER 3 YEARS. THE RESULTS OF THE AUDITS CONDUCTED BY THE OPERATOR LICENSING BRANCH AND THE OFFICE OF INSPECTION AND ENFORCEMENT ARE DISCUSSED. THE PROGRAMS HAVE IMPROVED DURING THIS 3-YEAR PERIOD AND, IN THE OPINION OF MANY, ARE BENEFICIAL TO THE NUCLEAR INDUSTRY.

19-5-1-541 LIGHT WATER REACTOR SAFETY RESEARCH IN JAPAN
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS PREPARED BY THE EDITORS OF NUCLEAR SAFETY AND IS BASED ENTIRELY ON SEVERAL REPORTS OF THE JAPANESE WORK THAT HAVE BEEN RECEIVED IN THIS COUNTRY THROUGH THE AGREEMENT BETWEEN THE NUCLEAR REGULATORY

COMMISSION AND JAPAN FOR THE EXCHANGE OF INFORMATION ON WATER REACTOR SAFETY RESEARCH. ALTHOUGH WE EXPECT TO PUBLISH AN ARTICLE BY A JAPANESE AUTHOR IN 1979 ON THEIR EXPERIMENTAL RESULTS, THE PRESENT ARTICLE WILL PROVIDE MUCH USEFUL BACKGROUND INFORMATION ON THEIR PROGRAM. TO THE EXTENT POSSIBLE, WE HAVE USED THE PHRASEOLOGY OF THE JAPANESE REPORTS IN DESCRIBING THEIR WORK. OUR THOUGHTS ARE INTRODUCED ONLY AT THE END OF THE ARTICLE UNDER THE SUBHEADING COMMENTARY. THE DOCUMENTS DESCRIBING THE JAPANESE PROGRAM DO NOT GIVE FUNDING LEVELS OR IDENTIFY THE RESPONSIBLE RESEARCH ORGANIZATIONS, EXCEPT FOR THE FACT THAT ALMOST ALL THE WORK IS COORDINATED WITH, OR THROUGH, THE JAPAN ATOMIC ENERGY RESEARCH INSTITUTE. HOWEVER, THE PROGRAMMATIC RESPONSIBILITIES OF VARIOUS JAPANESE RESEARCH ORGANIZATIONS CAN BE INFERRED FROM THE TOPICAL REPORTS THAT WE HAVE RECEIVED AS A PART OF THE EXCHANGE AGREEMENT. THESE DOCUMENTS ARE LISTED IN THE BIBLIOGRAPHY AND ARE DISCUSSED IN GENERAL IN THE COMMENTARY.

19-5-1-556 THE ROLE OF RISK ASSESSMENT IN THE NUCLEAR REGULATORY PROCESS
LEVINE, SAUL
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE JUDICIOUS APPLICATION OF RISK ASSESSMENT TECHNIQUES CAN HELP TO REDUCE PRESENT REGULATORY UNCERTAINTIES, AND THE ACCEPTABILITY OF SUCH TECHNIQUES IS GAINING SUPPORT. ALTHOUGH THE APPLICATION OF THESE TECHNIQUES, IN THE MANNER OF REPORT WASH-1400 (THE REACTOR SAFETY STUDY), TO EACH PLANT WOULD BE FORMIDABLE, A PROBABILISTIC APPROACH CAN GUIDE THE DECISION MAKERS INVOLVED IN THE LICENSING PROCESS. SEVERAL EXAMPLES OF THE USE OF A PROBABILISTIC APPROACH ARE GIVEN. THE RISK ASSESSMENT TOOLS WILL BE INFACVED UNDER A PLAN SUBMITTED TO CONGRESS TO IMPROVE REACTOR SAFETY. THE QUESTION OF ACCEPTABLE RISK CRITERIA WILL BE ADDRESSED IN THE ONGOING NUCLEAR REGULATORY COMMISSION (NRC) RESEARCH PROGRAM. IT IS EXPECTED THAT THE CONTINUED USE OF RISK ASSESSMENT TECHNIQUES WILL HELP TO IMPROVE THE EFFICIENCY AND THE STABILIZATION OF THE REGULATORY PROCESS BY FOCUSING THE ATTENTION OF THE NRC STAFF ON THE IMPORTANT CONTRIBUTORS TO RISK.

19-5-2-565 FRAP FUEL BEHAVIOR COMPUTER CODES
OEHLBERG, R. H. + JOHNSTON, W. V. + DEARIEN, J. A.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C. / EG+G IDAHO, INC., IDAHO FALLS, IDAHO
THE FUEL ROD ANALYSIS PROGRAM (FRAP) COMPUTER CODES BEING DEVELOPED BY THE NUCLEAR REGULATORY COMMISSION (NRC) ARE REVIEWED. THE FRAP-S (THE STEADY STATE CODE) IS DESIGNED TO PROVIDE INITIAL CONDITIONS FOR FRAP-T (THE TRANSIENT CODE). THE MODELS CONTAINED IN EACH CODE, THE ABILITY OF THE RECENT VERSIONS OF THE CODES TO PREDICT EXPERIMENTS, AND JUDGMENTS AS TO THE CODES' STRENGTHS AND WEAKNESSES ARE PRESENTED. FUTURE DEVELOPMENT OF THE FRAP-T CODE IS DISCUSSED, AND A LISTING OF POTENTIALLY DESIRABLE MODELS FOR THE NRC TRANSIENT AND STEADY STATE CODES ARE DISPLAYED. THE CONTENT OF THE MATERIAL PROPERTIES PACKAGE (MATPRO) IS OUTLINED. THE MODULAR MATPRO IS ACTIVELY LINKED TO BOTH FRAP-T AND FRAP-S TO PROVIDE A WELL DOCUMENTED AND CONSISTENT SET OF MATERIAL PROPERTIES FOR THE FRAP CODES.

19-5-2-583 FRAP FUEL BEHAVIOR COMPUTER CODES - ADDENDUM ON FRAP-S3
MARINO, G. P.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
AFTER THE PRECEDING ARTICLE WAS COMPLETED, THE LATEST VERSION OF THE STEADY STATE CODE (FRAP-S3) WAS DEVELOPED AND QUALIFIED. THIS ADDENDUM DESCRIBES THE IMPROVEMENTS IN FRAP-S3 AS WELL AS ITS QUALIFICATION IN A NUMBER OF PERFORMANCE CALCULATIONS. THE STANDARD ERRORS FOR THE CALCULATION OF A NUMBER OF OUTPUT PARAMETERS ARE PRESENTED.

19-5-3-590 ASSESSMENT OF SEISMIC TRIP SYSTEMS FOR COMMERCIAL POWER REACTORS
CUMMINGS, G. E. + WELLS, J. E. + LAMBERT, H. E.
LAWRENCE LIVERMORE LABORATORY, LIVERMORE, CALIF.
THIS ARTICLE ASSESSES THE VALUE OF SEISMIC TRIP (SCRAM) SYSTEMS ON COMMERCIAL NUCLEAR POWER REACTORS. EXPERIENCES WITH SEISMIC TRIP SYSTEMS ON RESEARCH AND TEST REACTORS ARE REVIEWED AS ARE CURRENT REGULATIONS CONCERNING SEISMIC INSTRUMENTATION ON POWER REACTORS. THE ADVANTAGES AND DISADVANTAGES OF SEISMIC TRIPS ARE DISCUSSED, AND A COMPARATIVE RISK ASSESSMENT IS MADE USING FAULT TREE TECHNIQUES. ALSO EXPLORED IS THE POSSIBILITY OF USING A PRECURSOR SIGNAL FROM AN EARTHQUAKE TO TRIP THE REACTOR BEFORE THE ARRIVAL OF STRONG MOTION.

19-5-5-632 SCENARIOS OF CARBON-14 RELEASES FROM THE WORLD NUCLEAR POWER INDUSTRY FROM 1975 TO 2020 AND THE ESTIMATED RADIOLOGICAL IMPACT
KILLOUGH, G. G. + TILL, J. E.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE PRESENTS AN ASSESSMENT OF THE RADIATION DOSE TO THE WORLD POPULATION AND THE ASSOCIATED POTENTIAL HEALTH EFFECTS FROM THREE SCENARIOS OF CARBON-14 RELEASES BY THE NUCLEAR INDUSTRY BETWEEN 1975 AND 2020. MEASURES OF HEALTH IMPACT ARE DERIVED FROM SOURCE TERMS THROUGH THE USE OF A MULTICOMPARTMENT MODEL OF THE GLOBAL CARBON CYCLE, DOSE RATE FACTORS BASED ON CARBON-14 SPECIFIC ACTIVITY IN VARIOUS ORGANS OF MAN, AND HEALTH EFFECT INCIDENCE FACTORS RECENTLY

RECOMMENDED BY THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION (ICRP). THE THREE SCENARIOS FOR WORLDWIDE CARBON-14 RELEASES CONSIDERED ARE (1) A PESSIMISTIC SCENARIO IN WHICH ALL THE CARBON-14 PROJECTED TO BE PRODUCED IN FUEL CYCLES IS RELEASED, (2) AN OPTIMISTIC SCENARIO THAT ASSUMES A DECONTAMINATION FACTOR OF 100 FOR FUEL REPROCESSING, AND (3) AN INTERMEDIATE SCENARIO THAT SIMULATES A PHASED IMPROVEMENT IN THE EFFLUENT TREATMENT TECHNOLOGY AT REPROCESSING PLANTS. THE ESTIMATES OF CUMULATIVE POTENTIAL HEALTH EFFECTS BASED ON INTEGRATION OVER INFINITE TIME (EFFECTIVELY 46,000 YEARS OR ABOUT 8 HALF LIVES OF CARBON-14) ARE AS FOLLOWS - 110,000 CANCERS AND 75,000 GENETIC EFFECTS FROM THE PESSIMISTIC SCENARIO, 21,000 CANCERS AND 14,000 GENETIC EFFECTS FROM THE OPTIMISTIC SCENARIO, 22,000 CANCERS AND 15,000 GENETIC EFFECTS FROM THE INTERMEDIATE SCENARIO, 100,000 CANCERS AND 68,000 GENETIC EFFECTS FROM THE CARBON-14 FORMED IN NATURE BETWEEN 1975 AND 2020, AND 380,000 CANCERS AND 250,000 GENETIC EFFECTS FROM THE CARBON-14 FORMED BY THE DETONATION OF NUCLEAR EXPLOSIVES FROM 1945 TO 1974. COMPARABLE EFFECTS FROM THE NATURALLY FORMED CARBON-14 IN STEADY STATE IN THE ENVIRONMENT, ALSO INTEGRATED OVER 46,000 YEARS, ARE APPROXIMATELY 66 MILLION CANCERS AND 43 MILLION GENETIC EFFECTS. THESE ESTIMATES ARE BASED ON A WORLD POPULATION THAT IS ASSUMED TO REMAIN STATIONARY AT 12.2 BILLION AFTER 2075.

19-5-5-617 RADIOLOGICAL QUALITY OF THE ENVIRONMENT IN THE UNITED STATES, 1977
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.

EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED BY THE NUCLEAR SAFETY STAFF FROM CHAP. 1, INTRODUCTION, SUMMARY, AND CONCLUSIONS, OF A REPORT OF THE SAME TITLE, WHICH WAS PUBLISHED IN SEPTEMBER 1977 BY THE ENVIRONMENTAL PROTECTION AGENCY AS EPA 520/1-009. THE REPORT AND ITS SUMMARY HERE PROVIDE SIGNIFICANT DATA ON DOSE ASSESSMENT FOR EVALUATING THE RADIOLOGICAL QUALITY OF THE ENVIRONMENT.

19-5-6-623 NUCLEAR REACTOR OPERATOR LICENSING
BURSEY, R. J.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.

THE ATOMIC ENERGY ACT OF 1954, WHICH WAS AMENDED IN 1974 BY THE ENERGY REORGANIZATION ACT, ESTABLISHED THE REQUIREMENT THAT INDIVIDUALS WHO HAD THE RESPONSIBILITY OF OPERATING THE REACTORS IN NUCLEAR POWER PLANTS MUST BE LICENSED. SECTION 107 OF THE ACT STATES THE COMMISSION SHALL (1) PRESCRIBE UNIFORM CONDITIONS FOR LICENSING INDIVIDUALS.... (2) DETERMINE THE QUALIFICATIONS OF SUCH INDIVIDUALS, AND (3) ISSUE LICENSES TO SUCH INDIVIDUALS IN SUCH FORM AS THE COMMISSION MAY PRESCRIBE. THIS ARTICLE DISCUSSES THE TYPES OF LICENSES, THE SELECTION AND TRAINING OF INDIVIDUALS, AND THE ADMINISTRATION OF THE NUCLEAR REGULATORY COMMISSION LICENSING EXAMINATIONS.

19-5-6-628 RADIOACTIVE MATERIALS RELEASED FROM NUCLEAR POWER PLANTS IN 1976
DECKER, T. R.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.

RELEASES OF RADIOACTIVE MATERIALS IN AIRBORNE AND LIQUID EFFLUENTS FROM COMMERCIAL LIGHT WATER REACTORS DURING 1976 HAVE BEEN COMPILED AND ARE REPORTED HERE. DATA ON SOLID-WASTE SHIPMENTS, AS WELL AS SELECTED OPERATING INFORMATION, ARE INCLUDED. THE REPORT FROM WHICH THIS ARTICLE IS ADAPTED SUPPLEMENTS EARLIER ANNUAL REPORTS ISSUED BY THE FORMER ATOMIC ENERGY COMMISSION (NOW DOE) AND THE NUCLEAR REGULATORY COMMISSION. THE 1976 RELEASE DATA ARE COMPARED WITH THE RELEASES OF PREVIOUS YEARS IN TABULAR FORM. IN ALL CASES THE TOTAL RELEASES WERE BELOW THE LIMITS SET FORTH IN APPLICABLE REGULATIONS AND IN THE TECHNICAL SPECIFICATIONS FOR EACH PLANT.

19-6-1-671 THE NRC PROGRAM OF INSPECTION AND ENFORCEMENT
LEDOUX, J. C. + REMFUSS, C.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.

THE NUCLEAR REGULATORY COMMISSION (NRC) REGULATES CIVILIAN USES OF NUCLEAR MATERIALS TO ENSURE THE PROTECTION OF THE PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT. THE OFFICE OF INSPECTION AND ENFORCEMENT (IE) DEVELOPS AND IMPLEMENTS THE INSPECTION, INVESTIGATION, AND ENFORCEMENT PROGRAMS FOR THE NRC. THE IE CONDUCTS INSPECTION PROGRAMS FOR REACTORS UNDER CONSTRUCTION AND IN OPERATION, NUCLEAR INDUSTRY VENDORS, FUEL FACILITIES AND USERS OF NUCLEAR MATERIALS, AND ALL ASPECTS OF THE SAFEGUARDING OF FACILITIES AND MATERIALS. RECENTLY THE IE BEGAN IMPLEMENTING A PROGRAM THAT WILL PLACE INSPECTORS ON SITE AT NUCLEAR POWER REACTORS AND WILL PROVIDE FOR NATIONAL APPRAISAL OF LICENSEE PERFORMANCE AND FOR AN EVALUATION OF THE EFFECTIVENESS OF THE INSPECTION PROGRAMS.

19-6-2-681 A REASSESSMENT OF TURBINE GENERATOR FAILURE PROBABILITY
BUSH, S. H.
BATTELLE PACIFIC NORTHWEST LABORATORIES, RICHLAND, WASH.

A PREVIOUS ARTICLE IN NUCLEAR SAFETY ASSESSED THE OVERALL PROBABILITY (P4) OF NUCLEAR PLANT DAMAGE DUE TO TURBINE FAILURES AS A FUNCTION OF THE COMBINED PROBABILITIES OF TURBINE FAILURE AND EJECTION OF AN ENERGETIC MISSILE (P1), A MISSILE STRIKING A CRITICAL COMPONENT (P2), AND SIGNIFICANT DAMAGE OCCURRING TO THE COMPONENT (P3). DUE TO QUESTIONS RAISED

CONCERNING THE METHODOLOGY USED. THE VALUE OF P1 HAS BEEN REASSESSED, USING A SOMEWHAT BROADER DATA BASE AND OTHER METHODS OF DATA ANALYSIS. THE RANGE OF INSTANTANEOUS TURBINE FAILURE RATES CONSIDERED RELEVANT TO NUCLEAR SYSTEMS IS 3.3 X 10(-5) TO 3.1 X 10(-4) PER TURBINE YEAR IN THE CURRENT ARTICLE COMPARED TO A VALUE OF 7 X 10(-5) PER TURBINE YEAR IN THE PREVIOUS ARTICLE.

19-6-2-699 FISSION GAS RELEASE FROM FUEL AT HIGH BURNUP
MEYER, R. O. + BEYER, C. E. + VOGLEWEDE, J. C.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE RELEASE OF FISSION GAS FROM FUEL PELLETS AT HIGH BURNUP IS REVIEWED IN THE CONTEXT OF THE SAFETY ANALYSIS PERFORMED FOR REACTOR LICENSE APPLICATIONS. LICENSING ACTIONS THAT WERE TAKEN TO CORRECT DEFICIENT GAS RELEASE MODELS USED IN THESE SAFETY ANALYSES ARE DESCRIBED. A CORRECTION FUNCTION, WHICH WAS DEVELOPED BY THE NUCLEAR REGULATORY COMMISSION STAFF AND ITS CONSULTANTS, IS PRESENTED. RELATED INFORMATION, INCLUDING SOME PREVIOUSLY UNPUBLISHED DATA, IS ALSO SUMMARIZED. THE ARTICLE THUS PROVIDES GUIDANCE FOR THE ANALYSIS OF HIGH-BURNUP GAS RELEASE IN LICENSING SITUATIONS.

19-6-3-712 APPLICATION OF REACTOR SCRAM EXPERIENCE IN RELIABILITY ANALYSIS OF SHUTDOWN SYSTEMS
EDISON, G. E. + GERSTNER, M. T.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
SCRAM EXPERIENCE AT A LIQUID METAL COOLED FAST BREEDER REACTOR (LMFBR) AND 14 COMMERCIAL LIGHT WATER REACTORS (LWRS) HAS BEEN REVIEWED AND ANALYZED FOR APPLICATION IN THE RELIABILITY ANALYSIS OF LMFBR SHUTDOWN SYSTEMS. THE DATE AND REACTOR POWER FOR EACH SCRAM WERE COMPILED FROM MONTHLY PLANT OPERATING REPORTS AND PERSONAL COMMUNICATIONS WITH PLANT OPERATING PERSONNEL. THE SCRAM FREQUENCY IN THE EXPERIMENTAL BREEDER REACTOR II (EBR-II) HAS BEEN HIGHER THAN THAT IN COMMERCIAL LWRS BECAUSE OF ITS CONSERVATIVE SHUTDOWN SYSTEM DESIGN WHICH LEADS TO MORE SCRAMS FROM MINOR CAUSES. THE SCRAM FREQUENCY OF THE EBR-II HAS DECLINED RAPIDLY WITH OPERATING EXPERIENCE AS SOME OF THE OVERLY CONSERVATIVE SCRAMS ARE ELIMINATED. THE EBR-II DATA TREND AND OTHER FACTS SUGGEST THAT THE SCRAM FREQUENCY FOR LARGE LMFBRS IS LIKELY TO BE IN THE SAME GENERAL RANGE AS THAT FOR COMMERCIAL LWRS. THE SCRAM FREQUENCY CURVE IN LWRS RESEMBLES A RELIABILITY BATHTUB CURVE, WITH THE USEFUL LIFE PHASE OF OPERATION LEVELING OFF AT ABOUT 2.5 SCRAMS PER YEAR. A WEIBULL DISTRIBUTION APPEARS TO REPRESENT THE DATA WELL IN THE EARLY LIFE PORTION OF THE CURVE. NO SIGN OF A WEAR-OUT PHASE IS EVIDENT AFTER 16 YEARS OF OPERATION.

19-6-3-723 THE SEPARATION OF ELECTRICAL EQUIPMENT AND SYSTEMS IN NUCLEAR POWER PLANTS IN SWEDEN AND THE UNITED STATES
REISCH, F.
SWEDISH NUCLEAR POWER INSPECTORATE, STOCKHOLM, SWEDEN
DESIGN CRITERIA FOR THE SEPARATION OF CLASS 1E EQUIPMENT AND SYSTEMS AND THE SEPARATION REQUIREMENTS AS PRACTICED IN NUCLEAR POWER PLANTS IN SWEDEN AND IN THE UNITED STATES ARE COMPARED. SOME EXAMPLES ARE USED TO SHOW HOW THESE SAFETY REQUIREMENTS INFLUENCE CABLING INSTALLATION AND CONTROL ROOM DESIGN. ALSO, BRIEFLY DISCUSSED IS A DESIGN FEATURE USED TO SHUT DOWN THE REACTOR IN SOME POWER PLANTS IN OTHER COUNTRIES WHEN ACCESS TO THE CONTROL ROOM IS CONSIDERED TO BE TOO HAZARDOUS FOR THE OPERATOR.

19-6-5-732 PROTECTION OF THE THYROID GLAND IN THE EVENT OF RELEASES OF RADIOIODINE
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED BY THE NUCLEAR SAFETY STAFF FROM A REPORT OF THE SAME TITLE WHICH WAS ISSUED AUG.1,1977, BY THE NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS AS NCRP REPORT NO.55. THE REPORT AND ITS SUMMARY HERE PROVIDE USEFUL DATA ON MINIMIZING THE EFFECTS OF AN ACCIDENTAL RADIOIODINE RELEASE.

19-6-5-741 MEDICAL AND LEGAL IMPLICATIONS OF A LARGE RELEASE OF RADIOIODINE
METTLER, F. A., JR. + KELSEY, C. A. + BAKAR, M. S.
THE UNIVERSITY OF NEW MEXICO, ALBUQUERQUE, N.M. / FRANKLIN PIERCE LAW CENTER, CONCORD, N.H.
DATA FROM NCRP REPORT NO.55 BY THE NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS ARE USED IN A HYPOTHETICAL RELEASE SITUATION TO DELINEATE THE POTENTIAL MEDICAL AND LEGAL PROBLEMS THAT MAY ARISE FROM SUCH A RELEASE. AN ANALYSIS OF THESE PROBLEMS INDICATES THAT THE EFFECTS OF RADIOIODINE RELEASE ARE THE MOST IMPORTANT AND THAT GUIDELINES FOR COUNTERMEASURES AND FOLLOW-UP ACTION MUST BE DEVELOPED AND PROMULGATED. MODEL GUIDELINES BASED ON THE HYPOTHETICAL RELEASE ARE PRESENTED AND DISCUSSED.

19-6-6-748 STEAM-GENERATOR TUBE FAILURES - WORLD EXPERIENCE IN WATER COOLED NUCLEAR POWER REACTORS IN 1976
TATONE, O. S. + PATHANIA, R. S.
CHALK RIVER NUCLEAR LABORATORIES, ONTARIO, CANADA
A SURVEY WAS CONDUCTED OF EXPERIENCE WITH STEAM-GENERATOR TUBES AT NUCLEAR POWER STATIONS DURING 1976. FAILURES WERE REPORTED AT 25 OUT OF 68 WATER-COOLED REACTORS. THE CAUSES OF THESE FAILURES AND THE REPAIR AND INSPECTION PROCEDURES DESIGNED TO COPE WITH THEM ARE SUMMARIZED. EXAMINATION OF THE DATA

INDICATES THAT CORROSION WAS THE MAJOR CAUSE OF STEAM GENERATOR TUBE FAILURES. IMPROVEMENTS ARE NEEDED IN STEAM GENERATOR DESIGN, CONDENSER INTEGRITY, AND SECONDARY WATER CHEMISTRY CONTROL.

19-9-6-760 OCCUPATIONAL RADIATION EXPOSURE AT LIGHT WATER COOLED NUCLEAR POWER REACTORS, 1969-1976
JOHNSON, L. A.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THIS ARTICLE, WHICH IS ADAPTED FROM A REPORT BY THE NUCLEAR REGULATORY COMMISSION (REPORT NUREG-0323), PRESENTS AN UPDATED COMPILATION OF OCCUPATIONAL RADIATION EXPOSURES AT COMMERCIAL LIGHT WATER COOLED NUCLEAR POWER REACTORS FOR THE YEARS 1969 THROUGH 1976. THE INFORMATION IN THIS DOCUMENT WAS DERIVED FROM REPORTS SUBMITTED ANNUALLY TO THE NUCLEAR REGULATORY COMMISSION IN ACCORDANCE WITH REQUIREMENTS OF THE TECHNICAL SPECIFICATIONS FOR INDIVIDUAL PLANTS. AN ADDITIONAL 9 LIGHT WATER REACTORS COMPLETED A FULL CALENDAR YEAR OF COMMERCIAL OPERATION FOR THE FIRST TIME IN 1976, INCREASING THE TOTAL NUMBER OF OPERATING NUCLEAR POWER PLANTS TO 53. THE NUMBER OF PERSONNEL MONITORED AT LIGHT WATER REACTORS INCREASED ABOUT 34 PERCENT IN 1976, AND THE AVERAGE COLLECTIVE DOSE TO PERSONNEL (MAN-REMS PER REACTOR-YEAR) INCREASED 9 PERCENT OVER THE 1975 AVERAGE. THE AVERAGE NUMBER OF PERSONNEL RECEIVING MEASURABLE EXPOSURE PER REACTOR INCREASED 7 PERCENT, AND THE AVERAGE EXPOSURE PER INDIVIDUAL IN 1976 WAS 0.7 REM PER PERSON.

Section 2

PERMUTED-TITLE (KWIC) INDEX

A KWIC (KeyWord In Context) index is one in which article titles are permuted around the various significant words contained therein. For example, the title, "Design Basis for Nuclear Power Plant Protection Systems," is indexed under the words Design, Nuclear, Power, Plant, and Protection. The index words are arranged alphabetically in a column in the center of the page, with the titles permuted around them. In some cases, additional significant words in parentheses have been added to the title by the editors to allow more precise indexing. A slash (/) indicates the end of a title. The location of the articles listed in the main index (orange) is indicated by the seven-digit numbers in the column to the right of the page, as described in the Introduction.

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Section 3

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